SUPPORTING INFORMATION

Silver-promoted dearomative [3 + 4] cycloaddition of anthranils with α-isocyanoacetates: access to benzodiazepines

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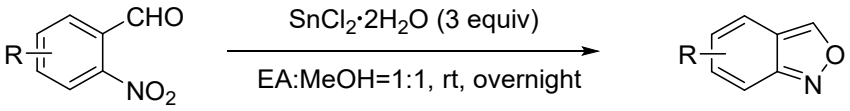
I. General Information

Unless otherwise specified, all reagents and starting materials were purchased from commercial sources and used as received. Solvents were used directly without further purification. The substrates of anthranils[1-4] and α-isocyanoacetates[5] were synthesized by reported methods. ^{1}H NMR (400 MHz), ^{1}H NMR (500 MHz) and ^{13}C NMR (100 MHz) were registered on 400 M spectrometers. Chemical shifts were reported in units (ppm) by assigning $CDCl_3$ resonance in the 1H spectrum as 7.26 ppm, $CDCl_3$ resonance in the ^{13}C spectrum as 77.0 ppm, DMSO – D_6 resonance in the ^{1}H spectrum as 2.5 ppm, DMSO - D_6 resonance in the ^{13}C spectrum as 39.52 ppm. All coupling constants (J values) were reported in Hertz (Hz). NMR analysis was carried out at 298 K unless noted otherwise HRMS was obtained on an ESI-LC-MS/MS spectrometer.

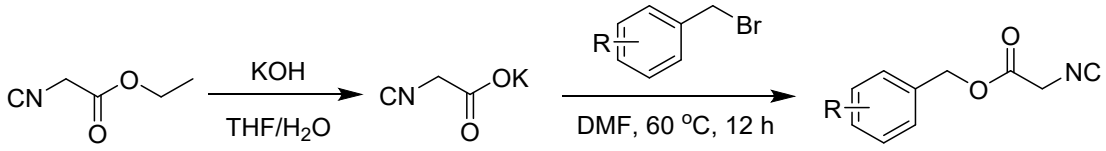
II. Preparation of Starting Materials

General procedure for the synthesis of anthranils[1]



A round bottom flask equipped with a magnetic stirrer bar was charged with the substituted 2-nitroacylbenzene (3.00 mmol) in EtOAc–MeOH (1:1; 20 mL). $SnCl_2 \cdot H_2O$ (9.00 mmol) was added and the reaction was stirred at room temperature for 24 h. The reaction was quenched by saturated $NaHCO_3$ (20 ml), and filtered. The aqueous phase was extracted with EtOAc (3×10 mL) and the organic portions combined, washed with H_2O (20 mL), saturated aqueous NaCl (20 mL), dried over Na_2SO_4, filtered and reduced in vacuo. The residue was purified by column chromatography (SiO_2, PE/EtOAc) to provide the title compound.

General Procedure for the Synthesis of α-isocyanoacetates[2]

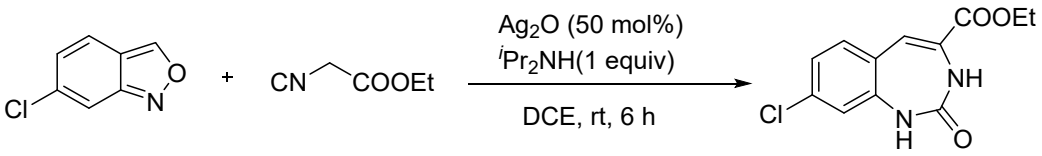


To a solution of the ethyl isocyanoacetate (10 mmol) in THF (20.0 mL) and water (5.0 mL) was added potassium hydroxide (10 mmol), and the resultant mixture was stirred at room temperature for 5 h. The solvent was then removed in vacuum and the resultant salt was used without further purification.

In a 50 mL Schlenk flask were placed potassium 2-isocyanoacetate (10.6 mmol), benzyl bromide (10.9 mmol), and dimethylformamide (DMF, 10 mL), and the resulting mixture was stirred at 60 ºC for 8 h. Then, DMF was removed under reduce pressure. To the residue was added water and extracted with ethyl acetate. The combined organic layer was dried over anhydrous Na_2SO_4. After concentration in vacuo, the residue was purified by column chromatography on SiO_2 with hexane/AcOEt (4/1) to give

title compound (612 mg, 3.38 mmol).

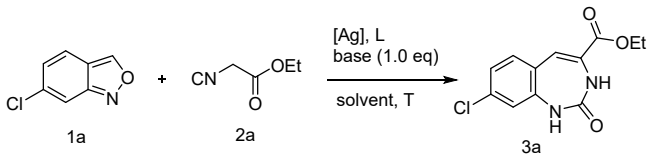
III. General procedure for the cycloaddition reaction

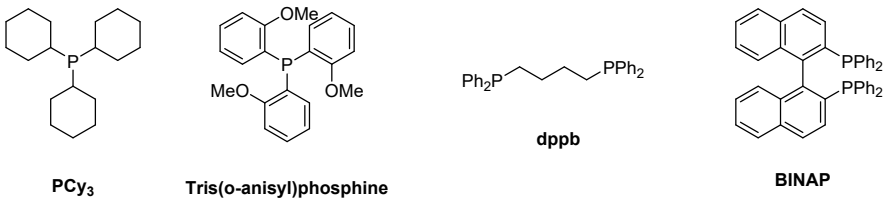


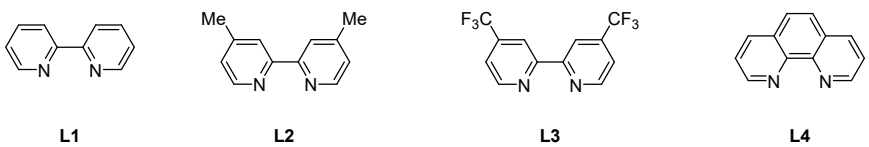
To a mixture of Anthranilide (0.1 mmol), Ag_2O (50 mol%), $^{i}Pr_2NH$ (0.1 mmol) in DCE (1 mL) was added of ethyl isocyanoacetate (0.5 mmol) in DCE (1 mL, analytical grade) via a syringe pump during a period of 4 h under Air at 25 °C, ang then stir for another 2 h. The reaction mixture was quenched with water and the aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over anhydrous Na_2SO_4 and evaporated under vaccuo. The residue was purified by silica gel flash column chromatography to afford the product.

IV. Optimization of Conditions

Optimization of the reaction conditions[a]





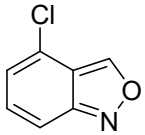


entry	[Ag]	ligand	base	solvent	Yield(%)
1	Ag_2O	PPh_3	$^{i}Pr_2NH$	DCE	19
2[b]	Ag_2O	PPh_3	$^{i}Pr_2NH$	DCE	7
3	Ag_2O	PCy_3	$^{i}Pr_2NH$	DCE	10

4	Ag_2O	Tris(o-anisyl)phosphine	$^iPr_2NH$	DCE	9
5	Ag_2O	dppb	$^iPr_2NH$	DCE	NR
6	Ag_2O	BINAP	$^iPr_2NH$	DCE	12
7	Ag_2O	L1	$^iPr_2NH$	DCE	57
8	Ag_2O	L2	$^iPr_2NH$	DCE	65
9	Ag_2O	L3	$^iPr_2NH$	DCE	45
10	Ag_2O	L4	$^iPr_2NH$	DCE	38
11	AgF	L2	$^iPr_2NH$	DCE	49
12	AgOAc	L2	$^iPr_2NH$	DCE	37
13	Ag_3PO_4	L2	$^iPr_2NH$	DCE	43
14	Ag_2CO_3	L2	$^iPr_2NH$	DCE	56
15	/	L2	$^iPr_2NH$	DCE	0
16	Ag_2O	L2	Bn_2NH	DCE	36
17	Ag_2O	L2	DIPEA	DCE	38
18	Ag_2O	L2	K_2CO_3	DCE	21
19	Ag_2O	L2	NaOAc	DCE	27
20	Ag_2O	L2	Amantadine	DCE	50
21	Ag_2O	L2	$^iPr_2NH$	Dioxane	33
22	Ag_2O	L2	$^iPr_2NH$	THF	24
23	Ag_2O	L2	$^iPr_2NH$	Toluene	44
24	Ag_2O	L2	$^iPr_2NH$	MeCN	21
25	Ag_2O	L2	$^iPr_2NH$	Ether	30
26	Ag_2O	L2	$^iPr_2NH$	MTBE	43
27	Ag_2O	L2	$^iPr_2NH$	PhCl	51
28[c]	Ag_2O	L2	$^iPr_2NH$	DCE	73
29[c]	Ag_2O	/	$^iPr_2NH$	DCE	55
30[c,d]	Ag_2O	/	$^iPr_2NH$	DCE	79
31[c,d]	Ag_2O	/	$^iPr_2NH$ (0.5equiv)	DCE	57
32[c,d]	Ag_2O	/	$^iPr_2NH$ (1.5equiv)	DCE	72
33[c,d]	Ag_2O	/	$^iPr_2NH$ (2.0equiv)	DCE	63
34[c,d,e]	Ag_2O	/	$^iPr_2NH$	DCE	53
35[c,d,f]	Ag_2O	/	$^iPr_2NH$	DCE	75

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (0.3 mmol), [Ag] (15 mol %), L (30 mol %), base (0.1 mmol), solvent (2.0 mL). A solution of **2a** in solvent (1 mL) was added slowly *via* a syringe pump in 4 h, and the reaction mixture was stirred for further 2 h at room temperature under air. Yields of isolated products. [b]PPh_3 (60 mol%). [c]**2a** (0.5 mmol). [d]Ag_2O (50 mol%) and without ligand. [e]**2a** was added in one portion. [f]Under Ar.

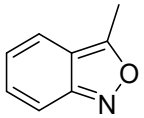
V. Characterization Data



4-chlorobenzo[*c*]isoxazole (1b)

Following the general procedure for the synthesis of anthranils: ^{1}H NMR (400 MHz, Chloroform-*d*) δ 9.21 (d, J = 1.1 Hz, 1H), 8.00 – 7.38 (m, 1H), 7.25 (dd, J = 9.0, 6.9 Hz, 1H), 7.02 (d, J = 6.9 Hz, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 156.58, 154.87, 131.16, 125.28, 123.29, 119.41, 113.79.

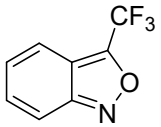
HRMS (ESI) Calc. for $C_7H_5ClNO^+$ $[M+H]^+$: 154.0054; found: 154.0055.



3-methylbenzo[*c*]isoxazole (1ae)

Following the general procedure for the synthesis of anthranils: ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.49 (dd, J = 9.1, 2.8 Hz, 1H), 7.42 (ddd, J = 8.8, 2.8, 1.4 Hz, 1H), 7.32 – 7.19 (m, 1H), 7.00 – 6.84 (m, 1H), 2.76 (d, J = 1.5 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 165.74, 157.04, 130.84, 122.77, 119.90, 115.62, 114.79, 11.96.

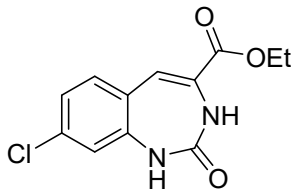
HRMS (ESI) Calc. for C_8H_8NO+ $[M+H]^+$: 134.0600; found: 134.0592.



3-(trifluoromethyl)benzo[*c*]isoxazole (1af)

Following the general procedure for the synthesis of anthranils: ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.70 (dd, J = 9.3, 1.1 Hz, 1H), 7.66 – 7.59 (m, 1H), 7.41 (dd, J = 9.2, 6.4 Hz, 1H), 7.23 (dd, J = 8.9, 6.4 Hz, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 156.94, 151.71 (q, J = 42.8 Hz), 131.49, 127.53, 118.87(q, J = 268.1 Hz), 117.99, 116.79, 115.60. ^{19}F NMR (377 MHz, $CDCl_3$) δ -61.98.

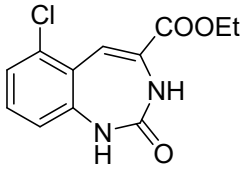
HRMS (ESI) Calc. for $C_8H_5F_3NO^+$ $[M+H]^+$: 188.0318; found: 188.0324.



8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepin-4-yl propionate (3a)

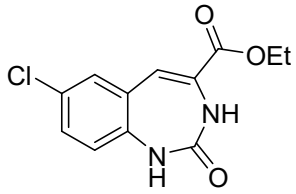
21.0 mg, 79% yield, yellow solid, MP = 199 – 200 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.03 (d, J = 2.2 Hz, 1H), 7.54 (t, J = 2.1 Hz, 1H), 7.22 (d, J = 8.3 Hz, 1H), 7.05 (dd, J = 8.3, 2.1 Hz, 1H), 6.99 (d, J = 2.1 Hz, 1H), 6.85 (d, J = 1.8 Hz, 1H), 4.25 (q, J = 7.1 Hz, 2H), 1.29 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 160.6, 140.3, 134.4, 132.4, 127.4, 123.5, 123.2, 119.6, 118.4, 61.9, 13.9.

HRMS (ESI) Calc. for $C_{12}H_{12}ClN_2O_3^+$ $[M+H]^+$: 267.0531; found: 267.0541.



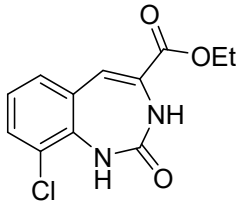
ethyl 6-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3b)

12.5 mg, 47% yield, yellow solid, MP = 186 – 187 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.11 (d, J = 2.3 Hz, 1H), 7.85 (t, J = 2.0 Hz, 1H), 7.28 (t, J = 8.0 Hz, 1H), 7.18 (dd, J = 8.0, 1.1 Hz, 1H), 7.12 (d, J = 1.7 Hz, 1H), 6.96 (dt, J = 8.1, 0.9 Hz, 1H), 4.27 (q, J = 7.1 Hz, 2H), 1.29 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.66, 141.42, 132.78, 131.47, 129.51, 124.42, 122.95, 119.86, 116.41, 62.16, 14.03.
HRMS (ESI) Calc. for $C_{12}H_{12}ClN_2O_3^+$ [M+H]$^+$: 267.0531; found: 267.0523.



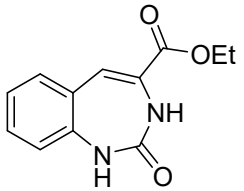
ethyl 7-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3c)

13.5 mg, 51% yield, yellow solid, MP = 172 – 173 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.04 (d, J = 3.0 Hz, 1H), 7.51 (s, 1H), 7.40 – 7.23 (m, 2H), 6.94 (t, J = 6.4 Hz, 1H), 6.87 (d, J = 3.4 Hz, 1H), 4.44 – 4.08 (m, 2H), 1.41 – 1.17 (m, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 161.2, 138.0, 130.0, 129.9, 128.4, 127.4, 126.7, 122.0, 118.1, 62.1, 14.0.
HRMS (ESI) Calc. for $C_{12}H_{12}ClN_2O_3^+$ [M+H]$^+$: 267.0531; found: 267.0530.



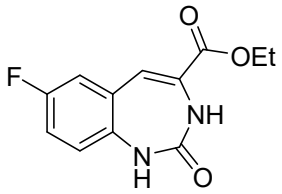
ethyl 9-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3d)

9.8 mg, 37% yield, yellow solid , MP = 145 – 146 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.98 (d, J = 2.5 Hz, 1H), 7.90 (t, J = 2.1 Hz, 1H), 7.48 (dt, J = 8.0, 1.1 Hz, 1H), 7.26 (dd, J = 7.7, 1.7 Hz, 1H), 7.15 – 7.08 (m, 1H), 7.05 (d, J = 1.8 Hz, 1H), 4.27 (q, J = 7.1 Hz, 2H), 1.30 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 161.9, 134.4, 130.5, 129.4, 129.2, 128.4, 125.2, 124.3, 119.5, 62.1, 14.0.
HRMS (ESI) Calc. for $C_{12}H_{12}ClN_2O_3^+$ [M+H]$^+$: 267.0531; found: 267.0538.

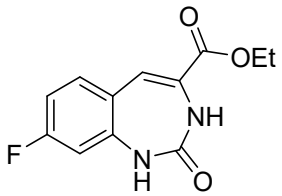


2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepin-4-yl propionate (3e)

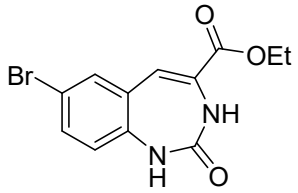
12.1 mg, 52% yield, yellow solid, MP = 150 – 151 °C, ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.24 – 7.16 (m, 1H), 7.08 – 6.96 (m, 2H), 6.89 (s, 1H), 6.84 (d, J = 1.8 Hz, 1H), 6.69 (d, J = 8.0 Hz, 1H), 4.33 (q, J = 7.1 Hz, 2H), 1.37 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.9, 161.3, 138.0, 131.1, 130.8, 126.7, 124.4, 124.1, 120.0, 119.2, 62.4, 14.2.
HRMS (ESI) Calc. for $C_{12}H_{13}N_2O_3^+$ $[M+H]^+$: 233.0921; found: 233.0930.



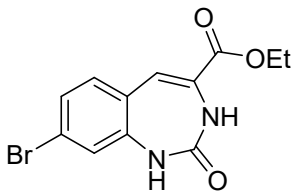
ethyl 7-fluoro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3f)
13.4 mg, 54% yield, yellow solid, MP = 161 – 162 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.94 (d, J = 2.3 Hz, 1H), 7.46 (d, J = 2.4 Hz, 1H), 7.22 – 7.03 (m, 2H), 6.94 (d, J = 5.1 Hz, 1H), 6.87 (d, J = 1.8 Hz, 1H), 4.25 (q, J = 7.1 Hz, 2H), 1.28 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 162.8, 161.8, 159.4, 135.5, 128.5, 126.8 (d, J = 8.1 Hz), 122.1 (d, J = 8.6 Hz), 118.4, 117.0 (d, J = 22.8 Hz), 116.4 (d, J = 23.5 Hz), 62.1, 14.0. ^{19}F NMR (376 MHz, DMSO-d_6) δ -120.8.
HRMS (ESI) Calc. for $C_{12}H_{12}FN_2O_3^+$ $[M+H]^+$: 251.0826; found: 251.0822.



8-fluoro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepin-4-yl propionate (3g)
14.9 mg, 60% yield, yellow solid, MP = 156 – 157 °C, ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.77 (s, 1H), 6.97 (dd, J = 8.6, 6.2 Hz, 1H), 6.92 (s, 1H), 6.77 (d, J = 1.9 Hz, 1H), 6.72 – 6.63 (m, 1H), 6.50 (dd, J = 9.7, 2.5 Hz, 1H), 4.32 (q, J = 7.1 Hz, 2H), 1.37 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 165.3, 162.8, 160.7, 140.0 (d, J = 10.3 Hz), 132.8 (d, J = 9.9 Hz), 125.8, 120.5 (d, J = 3.2 Hz), 118.5, 110.9 (d, J = 21.7 Hz), 107.4 (d, J = 25.4 Hz), 62.5, 14.18. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -109.2.
HRMS (ESI) Calc. for $C_{12}H_{12}FN_2O_3^+$ $[M+H]^+$: 251.0826; found: 251.0823.



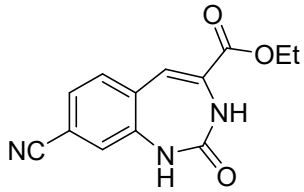
7-bromo-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepin-4-yl propionate (3h)
17.6 mg, 57% yield, yellow solid, MP = 189 – 190 °C, ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.29 (dd, J = 8.5, 2.3 Hz, 1H), 7.17 (d, J = 2.3 Hz, 1H), 6.92 (s, 2H), 6.74 (d, J = 1.8 Hz, 1H), 6.57 (d, J = 8.5 Hz, 1H), 4.33 (q, J = 7.1 Hz, 2H), 1.37 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.6, 160.5, 136.8, 133.3, 133.3, 127.6, 126.5, 121.5, 117.4, 116.8, 62.7, 14.1.
HRMS (ESI) Calc. for $C_{12}H_{12}BrN_2O_3^+$ $[M+H]^+$: 311.0026; found: 311.0027.



ethyl 8-bromo-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3i)

21.3 mg, 69% yield, yellow solid, MP = 185 – 186 °C, ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.12 (d, J = 1.9 Hz, 1H), 7.10 (d, J = 2.0 Hz, 1H), 6.94 (s, 1H), 6.90 – 6.85 (m, 2H), 6.76 (d, J = 1.8 Hz, 1H), 4.33 (q, J = 7.2 Hz, 2H), 1.37 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.7, 160.4, 138.9, 132.2, 127.2, 126.8, 124.2, 123.4, 122.8, 118.1, 62.6, 14.1.

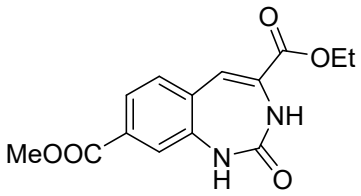
HRMS (ESI) Calc. for $C_{12}H_{12}BrN_2O_3^+$ $[M+H]^+$: 311.0026; found: 311.0029.



ethyl 8-cyano-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3j)

19.5 mg, 76% yield, yellow solid, MP = 193 – 194 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.19 (s, 1H), 7.76 (s, 1H), 7.44-7.38 (m 2H), 7.26 (d, J = 2.7 Hz, 1H), 6.87 (d, J = 2.9 Hz, 1H), 4.27 (td, J = 7.2, 2.5 Hz, 2H), 1.30 (qd, J = 7.0, 6.3, 2.9 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.5, 160.5, 139.5, 131.8, 129.8, 129.6, 126.9, 123.1, 118.3, 117.4, 112.1, 62.3, 14.0.

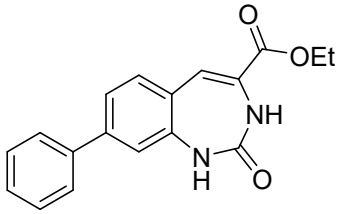
HRMS (ESI) Calc. for $C_{13}H_{12}N_3O_3^+$ $[M+H]^+$: 258.0873; found: 258.0872.



4-ethyl 8-methyl 2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4,8-dicarboxylate (3k)

21.4 mg, 74% yield, yellow solid, MP = 178 – 179 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.14 (d, J = 2.2 Hz, 1H), 7.61 (t, J = 2.0 Hz, 1H), 7.58 – 7.50 (m, 2H), 7.31 (d, J = 8.0 Hz, 1H), 6.88 (d, J = 1.8 Hz, 1H), 4.27 (q, J = 7.1 Hz, 2H), 1.30 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 165.4, 162.6, 160.8, 139.1, 131.1, 130.9, 129.4, 129.0, 123.9, 120.9, 117.8, 62.1, 52.3, 13.9.

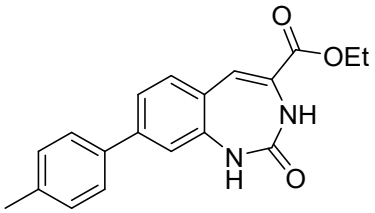
HRMS (ESI) Calc. for $C_{14}H_{15}N_2O_5^+$ $[M+H]^+$:291.0975; found: 251.0984.



ethyl 2-oxo-8-phenyl-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3l)

17.2 mg, 56% yield, yellow solid, MP = 214 – 215 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.98 (d, J = 2.3 Hz, 1H), 7.61 (dd, J = 8.2, 1.4 Hz, 2H), 7.47 (t, J = 7.6 Hz, 2H), 7.44 – 7.35 (m, 2H), 7.30 (dd, J = 8.1, 1.6 Hz, 1H), 7.28 – 7.23 (m, 2H), 6.90 (d, J = 1.7 Hz, 1H), 4.26 (q, J = 7.1 Hz, 2H), 1.30 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.9, 161.0, 142.2, 139.4, 138.8, 131.5, 129.0, 128.0, 127.0, 126.3, 123.7, 121.7, 118.9, 118.3, 61.9, 14.0.

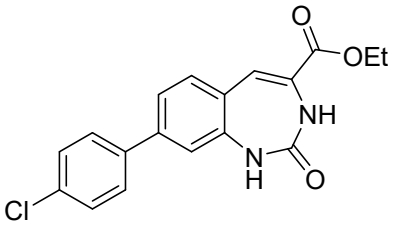
HRMS (ESI) Calc. for $C_{18}H_{17}N_2O_3^+$ $[M+H]^+$:309.1234; found: 309.1226.



ethyl 2-oxo-8-(p-tolyl)-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3m)

19.6 mg, 61% yield, yellow solid, MP = 205 – 206 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.95 (d, J = 2.3 Hz, 1H), 7.51 (d, J = 8.2 Hz, 2H), 7.40 (d, J = 2.1 Hz, 1H), 7.31 – 7.25 (m, 3H), 7.27 – 7.21 (m, 2H), 6.89 (d, J = 1.7 Hz, 1H), 4.26 (q, J = 7.0 Hz, 2H), 2.34 (s, 3H), 1.30 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 163.3, 161.4, 142.6, 139.9, 138.0, 136.4, 132.0, 130.1, 127.3, 126.6, 123.8, 121.8, 119.5, 118.4, 62.4, 21.1, 14.5.

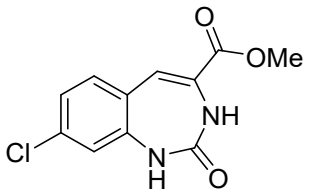
HRMS (ESI) Calc. for $C_{19}H_{19}N_2O_3^+$ $[M+H]^+$:323.1390; found: 323.1392.



ethyl 8-(4-chlorophenyl)-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3n)

21.6 mg, 63% yield, yellow solid, MP = 208 – 209 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.97 (d, J = 2.3 Hz, 1H), 7.68 – 7.60 (m, 2H), 7.57 – 7.48 (m, 2H), 7.44 (t, J = 2.1 Hz, 1H), 7.31 (dd, J = 8.0, 1.8 Hz, 1H), 7.30 – 7.21 (m, 2H), 6.90 (d, J = 1.8 Hz, 1H), 4.26 (q, J = 7.1 Hz, 2H), 1.30 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 163.3, 161.4, 141.2, 139.9, 138.1, 133.3, 132.1, 129.5, 128.6, 127.7, 124.5, 122.1, 119.3, 118.6, 62.4, 14.5.

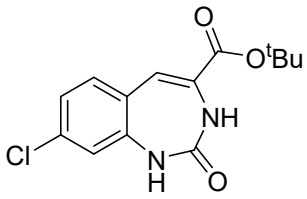
HRMS (ESI) Calc. for $C_{18}H_{16}ClN_2O_3^+$ $[M+H]^+$:343.0844; found: 343.0849.



methyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3o)

12.3 mg, 49% yield, yellow solid, MP = 175 – 176 °C, ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.33 (s, 1H), 7.00 – 6.88 (m, 3H), 6.77 (d, J = 1.8 Hz, 1H), 6.73 (t, J = 1.3 Hz, 1H), 3.88 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.2, 160.3, 138.9, 136.4, 132.1, 126.4, 124.3, 122.9, 120.0, 118.4, 53.2.

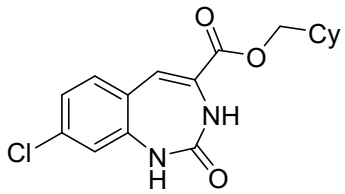
HRMS (ESI) Calc. for $C_{11}H_{10}ClN_2O_3^+$ $[M+H]^+$:253.0374; found: 253.0376.



tert-butyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3p)

19.9 mg, 68% yield, yellow solid, MP = 161 – 162 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.02 (d, J = 2.7 Hz, 1H), 7.38 (t, J = 2.1 Hz, 1H), 7.18 (d, J = 8.3 Hz, 1H), 7.03 (dd, J = 8.3, 2.0 Hz, 1H), 6.98 (d, J = 2.1 Hz, 1H), 6.75 (d, J = 1.6 Hz, 1H), 1.50 (s, 9H). ^{13}C NMR (100 MHz, DMSO) δ 161.8, 160.7, 140.3, 134.3, 132.4, 128.4, 123.7, 123.3, 119.6, 117.8, 82.7, 27.6.

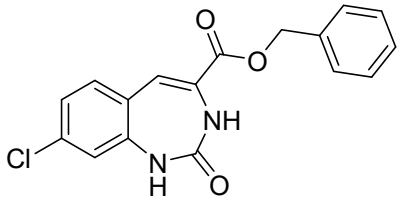
HRMS (ESI) Calc. for $C_{14}H_{16}ClN_2O_3^+$ $[M+H]^+$:295.0844; found: 295.0843.



cyclohexylmethyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3q)

19.0 mg, 57% yield, yellow solid, MP = 167 – 168 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.5 Hz, 1H), 7.75 – 7.38 (m, 1H), 7.22 (dd, J = 8.6, 5.1 Hz, 1H), 7.03 (dt, J = 8.2, 3.3 Hz, 1H), 6.99 (d, J = 2.2 Hz, 1H), 6.84 (d, J = 3.9 Hz, 1H), 4.01 (d, J = 6.4 Hz, 2H), 1.82 – 1.52 (m, 6H), 1.33 – 1.08 (m, 4H), 0.99 (t, J = 12.2 Hz, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.8, 160.7, 140.4, 134.5, 132.6, 127.3, 123.6, 123.3, 119.7, 118.5, 70.6, 29.0, 25.9, 25.2.

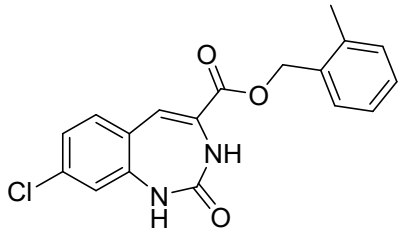
HRMS (ESI) Calc. for $C_{17}H_{20}ClN_2O_3^+$ $[M+H]^+$:335.1157; found:335.1158.



benzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3r)

23.2 mg, 71% yield, yellow solid, MP = 209 – 210 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.3 Hz, 1H), 7.62 (d, J = 2.1 Hz, 1H), 7.49 – 7.43 (m, 2H), 7.41 (t, J = 7.3 Hz, 2H), 7.38 – 7.34 (m, 1H), 7.24 (d, J = 8.4 Hz, 1H), 7.04 (dd, J = 8.3, 2.2 Hz, 1H), 7.00 (d, J = 2.1 Hz, 1H), 6.91 (d, J = 1.9 Hz, 1H), 5.28 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ 163.13, 161.24, 140.88, 136.02, 135.05, 133.03, 129.00, 128.77, 128.65, 127.71, 123.99, 123.72, 120.14, 119.49, 67.72.

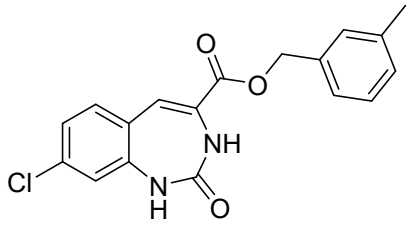
HRMS (ESI) Calc. for $C_{17}H_{14}ClN_2O_3^+$ $[M+H]^+$:329.0687; found:329.0681.



2-methylbenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3s)

22.5 mg, 66% yield, yellow solid, MP = 191 – 192 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.05 (d, J = 2.3 Hz, 1H), 7.67 – 7.48 (m, 1H), 7.39 (d, J = 7.4 Hz, 1H), 7.29-7.19 (m, 4H), 7.04-7.01 (m, 1H), 6.99 (d, J = 2.1 Hz, 1H), 6.87 (d, J = 1.9 Hz, 1H), 5.29 (s, 2H), 2.34 (s, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.6, 160.8, 140.4, 136.9, 134.6, 133.4, 132.6, 130.2, 129.2, 128.6, 127.2, 125.9, 123.5, 123.2, 119.6, 118.9, 65.8, 18.5.

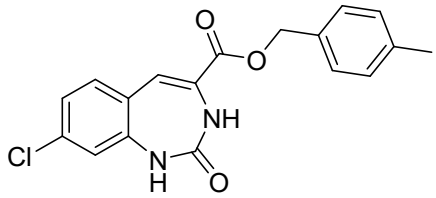
HRMS (ESI) Calc. for $C_{18}H_{16}ClN_2O_3^+$ $[M+H]^+$:343.0844; found: 343.0843.



3-methylbenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3t)

18.1 mg, 53% yield, yellow solid, MP = 186 – 187 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.2 Hz, 1H), 7.66 – 7.58 (m, 1H), 7.34 – 7.20 (m, 4H), 7.17 (d, J = 7.5 Hz, 1H), 7.04 (dt, J = 8.3, 1.8 Hz, 1H), 6.99 (d, J = 2.1 Hz, 1H), 6.90 (d, J = 1.9 Hz, 1H), 5.24 (s, 2H), 2.32 (s, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.6, 160.7, 140.4, 137.7, 135.4, 134.5, 132.5, 128.9, 128.8, 128.4, 127.2, 125., 123.5, 123.2, 119.6, 118.9, 67.3, 20.9.

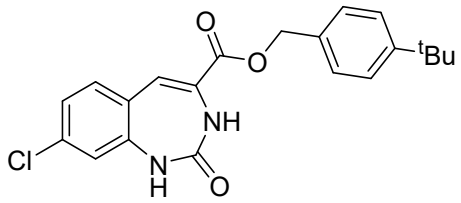
HRMS (ESI) Calc. for $C_{18}H_{16}ClN_2O_3^+$ $[M+H]^+$:343.0844; found:343.0842.



4-methylbenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3u)

19.8 mg, 58% yield, yellow solid, MP = 185 – 186 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.04 (s, 1H), 7.58 (s, 1H), 7.44 – 7.32 (m, 2H), 7.22 (tt, J = 7.4, 4.9, 4.3 Hz, 3H), 7.10 – 6.98 (m, 2H), 6.89 (d, J = 2.6 Hz, 1H), 5.23 (d, J = 2.9 Hz, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 160.8, 140.4, 137.8, 134.6, 132.6, 132.5, 129.1, 128.4, 127.3, 123.5, 123.3, 119.7, 118.9, 67.3, 20.8.

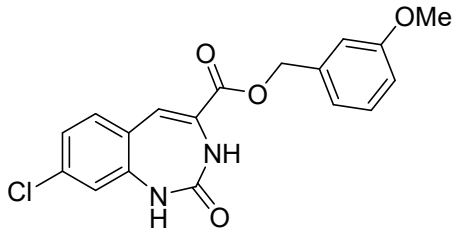
HRMS (ESI) Calc. for $C_{18}H_{16}ClN_2O_3^+$ $[M+H]^+$:343.0844; found: 343.0839.



4-(tert-butyl)benzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3v)

23.4 mg, 61% yield, yellow solid, MP = 196 – 197 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (s, 1H), 7.59 (s, 1H), 7.48 – 7.33 (m, 4H), 7.30 – 7.18 (m, 1H), 7.04 (dt, J = 8.3, 2.4 Hz, 1H), 6.99 (d, J = 2.0 Hz, 1H), 6.89 (d, J = 2.3 Hz, 1H), 5.23 (d, J = 2.1 Hz, 2H), 1.27 (d, J = 2.4 Hz, 9H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 160.8, 150.9, 140.4, 134.6, 132.6, 128.3, 128.2, 127.3, 125.4, 125.3, 123.6, 123.3, 119.7, 119.0, 67.2, 34.4, 31.1, 31.1.

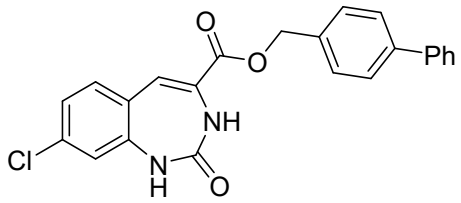
HRMS (ESI) Calc. for $C_{21}H_{20}ClN_2O_3^-$ [M-H]$^-$:383.1168; found:383.1155.



3-methoxybenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3w)

20.0 mg, 56% yield, yellow solid, MP = 190 – 191 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.2 Hz, 1H), 7.62 (d, J = 2.2 Hz, 1H), 7.31 (d, J = 8.2 Hz, 1H), 7.23 (d, J = 8.3 Hz, 1H), 7.08 – 6.98 (m, 4H), 6.95 – 6.89 (m, 2H), 5.24 (s, 2H), 3.76 (s, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.6, 160.8, 159.3, 140.4, 137.0, 134.6, 132.5, 129.6, 127.2, 123.5, 123.2, 120.2, 119.6, 119.1, 113.7, 67.1, 55.1.

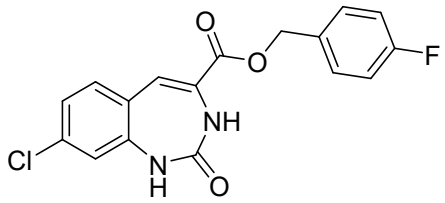
HRMS (ESI) Calc. for $C_{18}H_{16}ClN_2O_4^+$ [M+H]$^+$:359.0793; found:359.0791.



[1,1'-biphenyl]-4-ylmethyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3x)

21.4 mg, 53% yield, yellow solid, MP = 196 – 197 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.05 (d, J = 2.3 Hz, 1H), 7.74 – 7.66 (m, 4H), 7.64 (d, J = 2.2 Hz, 1H), 7.55 (d, J = 8.2 Hz, 2H), 7.47 (t, J = 7.7 Hz, 2H), 7.38 (d, J = 7.4 Hz, 1H), 7.24 (d, J = 8.3 Hz, 1H), 7.05 (dd, J = 8.3, 2.1 Hz, 1H), 7.00 (d, J = 2.1 Hz, 1H), 6.94 (d, J = 1.7 Hz, 1H), 5.33 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.8, 160.9, 140.5, 140.3, 139.8, 134.8, 134.7, 132.6, 129.1, 129.0, 127.7, 127.3, 126.9, 126.8, 123.6, 123.3, 119.7, 119.2, 67.1

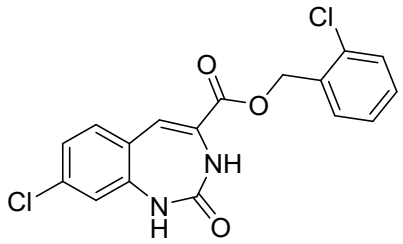
HRMS (ESI) Calc. for $C_{23}H_{16}ClN_2O_3^-$ [M-H]$^-$:403.0855; found: 403.0860.



4-fluorobenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3y)

17.9 mg, 52% yield, yellow solid, MP = 189 – 190 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.03 (d, J = 2.2 Hz, 1H), 7.62 (s, 1H), 7.56 – 7.49 (m, 2H), 7.28 – 7.20 (m, 3H), 7.04 (dd, J = 8.3, 2.1 Hz, 1H), 6.99 (d, J = 2.1 Hz, 1H), 6.90 (s, 1H), 5.26 (s, 1H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 163.3, 162.7, 160.9, 160.8, 140.5, 134.6, 132.6, 131.9, 131.8, 130.7 (d, J = 8.4 Hz), 127.3, 123.4 (d, J = 25.3 Hz), 119.4 (d, J = 57.7 Hz), 115.4 (d, J = 21.4 Hz), 66.6. ^{19}F NMR (376 MHz, DMSO-d_6) δ -113.7.

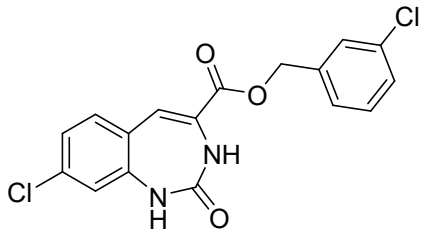
HRMS (ESI) Calc. for $C_{17}H_{13}ClFN_2O_3^+$ $[M+H]^+$:347.0593; found:347.0598.



2-chlorobenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3z)

26.1 mg, 72% yield, yellow solid, MP = 195 – 196 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.05 (d, J = 2.9 Hz, 1H), 7.69 – 7.58 (m, 2H), 7.53 (ddd, J = 9.2, 5.2, 2.3 Hz, 1H), 7.45 – 7.37 (m, 2H), 7.24 (d, J = 8.5 Hz, 1H), 7.08 – 6.97 (m, 2H), 6.92 (d, J = 2.0 Hz, 1H), 5.36 (s, 1H). ^{13}C NMR (100 MHz, DMSO) δ 162.9, 161.2, 140.9, 135.1, 133.3, 133.1, 133.0, 130.9, 130.7, 129.9, 127.9, 127.4, 123.9, 123.7, 120.1, 119.7, 65.1.

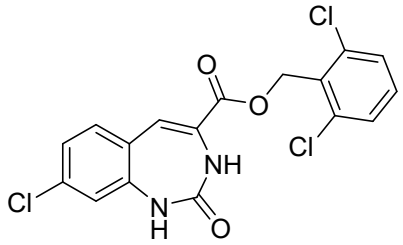
HRMS (ESI) Calc. for $C_{17}H_{11}Cl_2N_2O_3^-$ $[M-H]^-$:361.0152; found:361.0157.



3-chlorobenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3aa)

30.7 mg, 85% yield, yellow solid, MP = 179 – 180 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.3 Hz, 1H), 7.68 (t, J = 1.9 Hz, 1H), 7.56 (dd, J = 2.0, 0.9 Hz, 1H), 7.44 (d, J = 1.3 Hz, 3H), 7.24 (d, J = 8.3 Hz, 1H), 7.05 (dd, J = 8.3, 2.1 Hz, 1H), 7.00 (d, J = 2.2 Hz, 1H), 6.94 (d, J = 1.7 Hz, 1H), 5.28 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.6, 160.8, 140.5, 138.1, 134.6, 133.1, 132.6, 130.5, 128.2, 128.0, 127.2, 126.8, 126.8, 123.5, 123.3, 119.7, 119.3, 66.4.

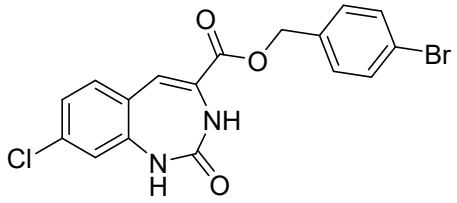
HRMS (ESI) Calc. for $C_{17}H_{13}Cl_2N_2O_3^+$ $[M+H]^+$:363.0298; found: 363.0305.



2,6-dichlorobenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3ab)

34.3 mg, 87% yield, yellow solid, MP = 215 – 216 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.3 Hz, 1H), 7.63 (t, J = 2.0 Hz, 1H), 7.60 – 7.55 (m, 2H), 7.48 (dd, J = 8.8, 7.3 Hz, 1H), 7.20 (d, J = 8.3 Hz, 1H), 7.02 (dd, J = 8.3, 2.1 Hz, 1H), 6.99 (d, J = 2.1 Hz, 1H), 6.80 (d, J = 1.7 Hz, 1H), 5.48 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.4, 160.8, 140.4, 136.1, 134.6, 132.6, 131.8, 130.4, 128.8, 126.8, 123.3, 123.2, 119.6, 119.3, 62.4.

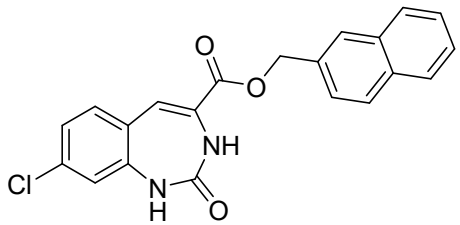
HRMS (ESI) Calc. for $C_{17}H_{12}Cl_3N_2O_3^+$ $[M+H]^+$:396.9908; found:396.9899.



4-bromobenzyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3ac)

30.7 mg, 76% yield, yellow solid, MP = 205 – 206 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.3 Hz, 1H), 7.64 (d, J = 2.1 Hz, 1H), 7.62 – 7.57 (m, 2H), 7.46 – 7.40 (m, 2H), 7.23 (d, J = 8.3 Hz, 1H), 7.05 (dd, J = 8.3, 2.2 Hz, 1H), 6.99 (d, J = 2.2 Hz, 1H), 6.91 (d, J = 1.8 Hz, 1H), 5.25 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ 163.0, 161.2, 140.8, 135.4, 135.0, 132.9, 131.8, 130.8, 127.5, 123.9, 123.6, 121.9, 120.1, 119.6, 66.8.

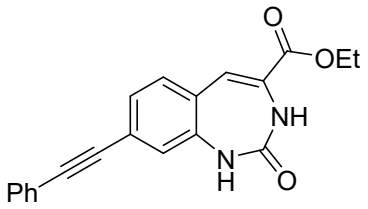
HRMS (ESI) Calc. for $C_{17}H_{11}BrClN_2O_3^-$ $[M-H]^-$:404.9647; found:404.9647.



naphthalen-2-ylmethyl 8-chloro-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (3ad)

28.3 mg, 75% yield, yellow solid, MP = 207 – 208 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.3 Hz, 1H), 8.01 – 7.98 (m, 1H), 7.98 – 7.89 (m, 3H), 7.65 (t, J = 2.1 Hz, 1H), 7.59 (dd, J = 8.5, 1.8 Hz, 1H), 7.56 – 7.51 (m, 2H), 7.23 (d, J = 8.3 Hz, 1H), 7.03 (dd, J = 8.3, 2.1 Hz, 1H), 6.99 (d, J = 2.1 Hz, 1H), 6.94 (d, J = 1.7 Hz, 1H), 5.44 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 160.8, 140.4, 134.6, 133.1, 132.7, 132.6, 128.2, 127.9, 127.6, 127.2, 127.1, 126.4, 126.0, 123.5, 123.2, 119.6, 119.1, 67.4.

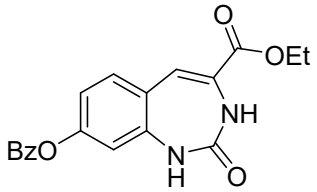
HRMS (ESI) Calc. for $C_{21}H_{16}ClN_2O_3^+$ $[M+H]^+$:379.0844; found:379.0849.



ethyl 2-oxo-8-(phenylethynyl)-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (4)

28.8 mg, 88% yield, yellow solid, MP = 197 – 198 °C, ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.04 (d, J = 2.4 Hz, 1H), 7.59 – 7.49 (m, 3H), 7.43 (dt, J = 5.1, 1.9 Hz, 3H), 7.26 – 7.20 (m, 1H), 7.15 (dd, J = 7.9, 1.7 Hz, 1H), 7.08 (d, J = 1.5 Hz, 1H), 6.85 (d, J = 1.9 Hz, 1H), 4.25 (q, J = 7.1 Hz, 2H), 1.29 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 162.7, 160.7, 139.1, 131.4, 131.3, 129.1, 128.8, 127.7, 126.4, 125.7, 123.9, 122.4, 121.8, 118.4, 91.0, 88.6, 62.0, 14.0.

HRMS (ESI) Calc. for $C_{20}H_{17}N_2O_3^+$ $[M+H]^+$:333.1234; found:333,1225.



ethyl 8-(benzoyloxy)-2-oxo-2,3-dihydro-1*H*-benzo[*d*][1,3]diazepine-4-carboxylate (5)

16.8 mg, 48% yield, yellow solid, MP = 193 – 194 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.05 (d, J = 2.2 Hz, 1H), 8.20 – 8.09 (m, 2H), 7.87 – 7.72 (m, 1H), 7.62 (t, J = 7.7 Hz, 2H), 7.51 (d, J = 2.1 Hz, 1H), 7.30 (d, J = 8.4 Hz, 1H), 6.96 (dd, J = 8.4, 2.2 Hz, 1H), 6.93 (d, J = 1.7 Hz, 1H), 6.85 (d, J = 2.3 Hz, 1H), 4.27 (q, J = 7.1 Hz, 2H), 1.31 (t, J = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 164.73, 163.3, 161.4, 152.4, 140.7, 134.7, 132.5, 130.3, 129.5, 129.0, 127.5, 123.0, 119.4, 117.5, 113.9, 62.4, 14.5.

HRMS (ESI) Calc. for $C_{19}H_{17}N_2O_5^+$ $[M+H]^+$:353.1132; found:353.1129.

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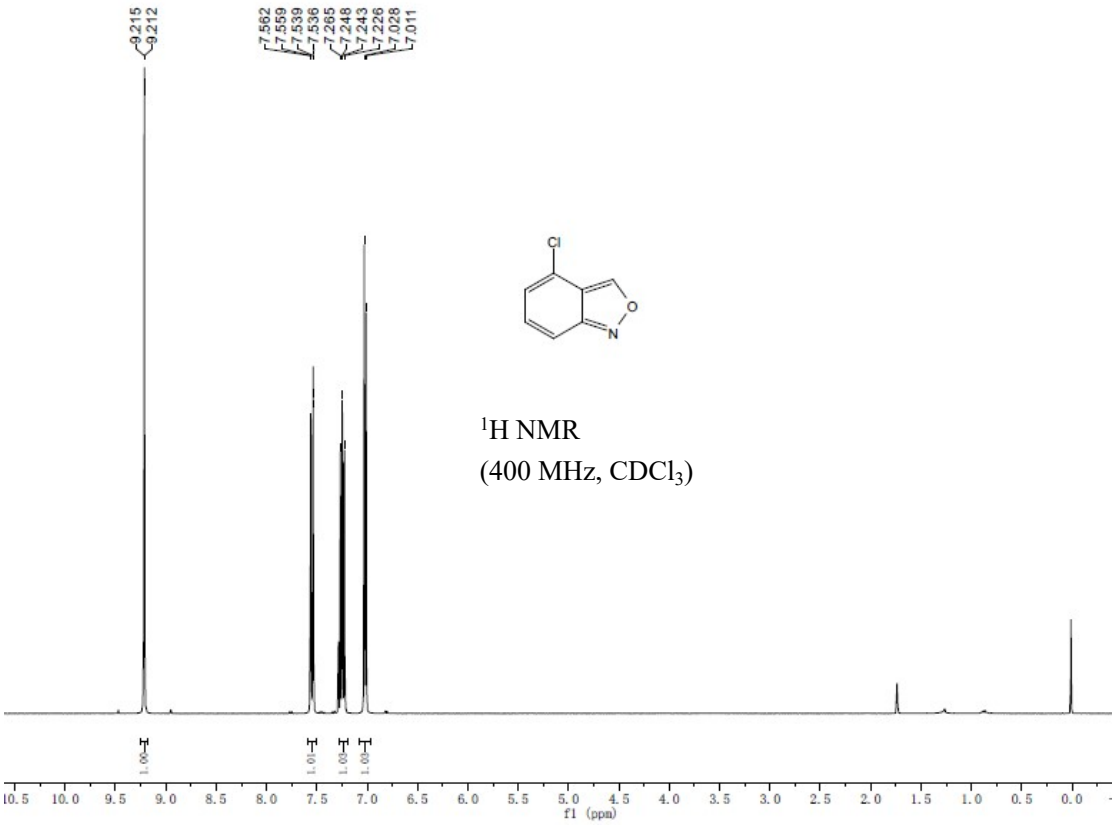
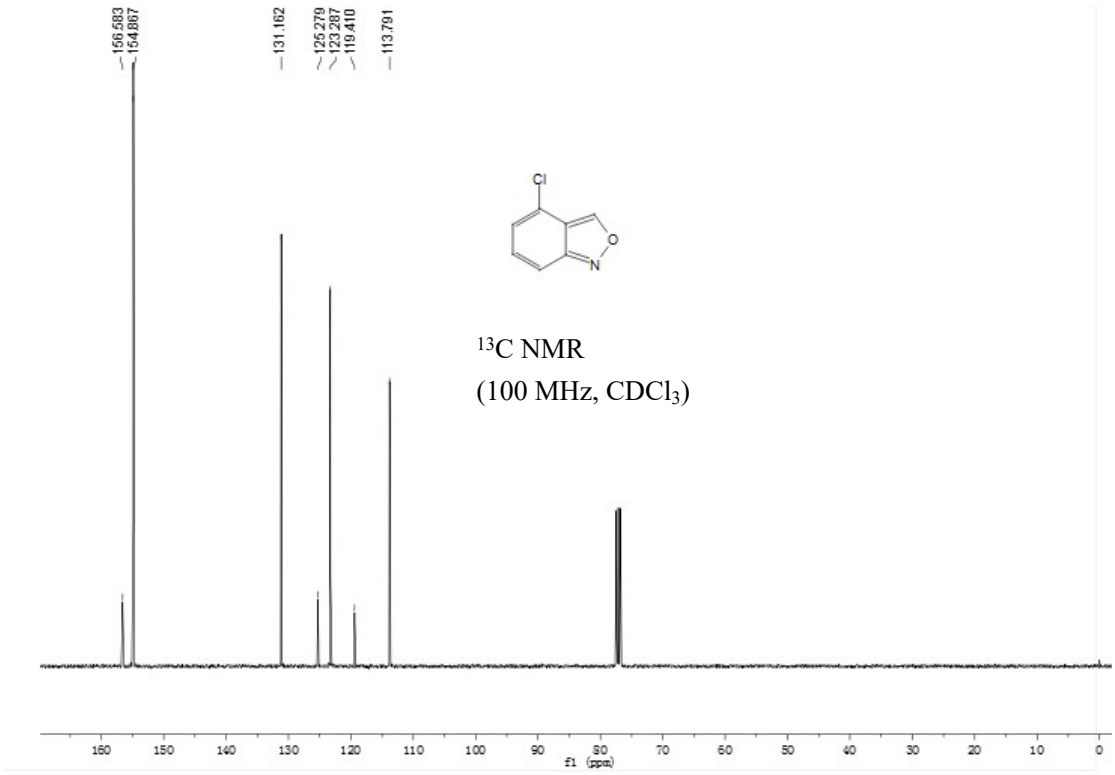
VI. Copies of ^{1}H and ^{13} C NMR Spectra

(1b)

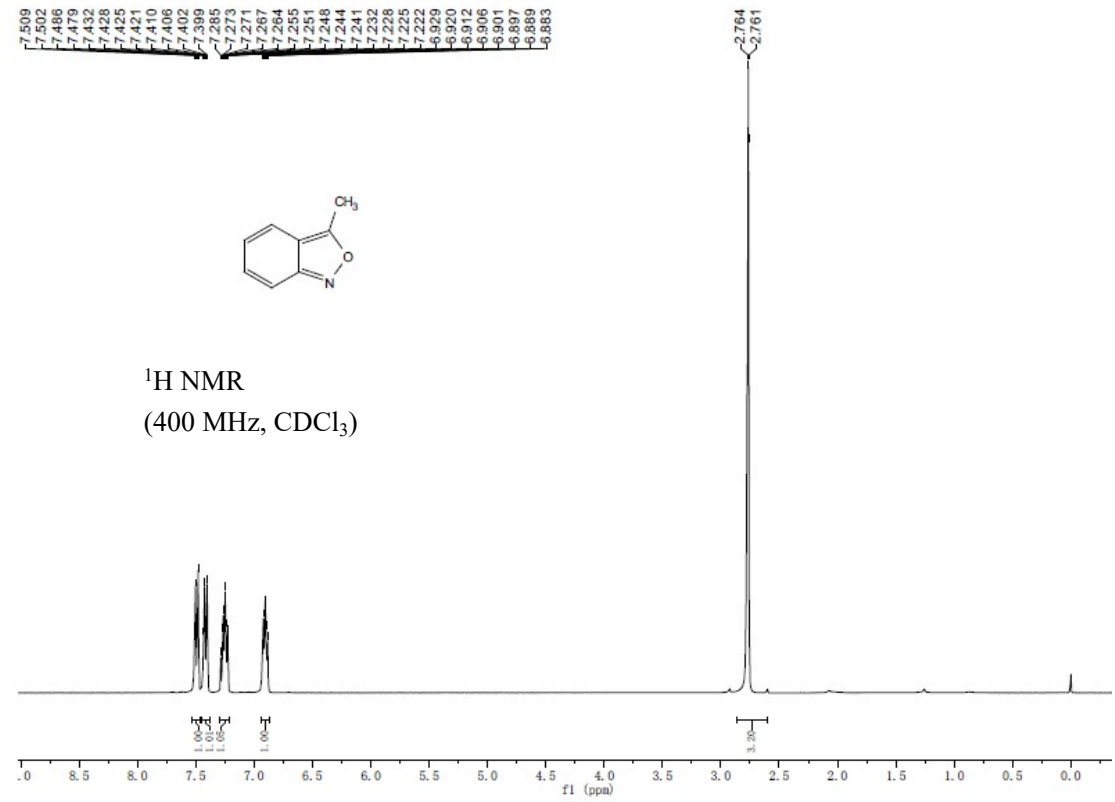


^{1}H NMR
(400 MHz, $CDCl_3$)

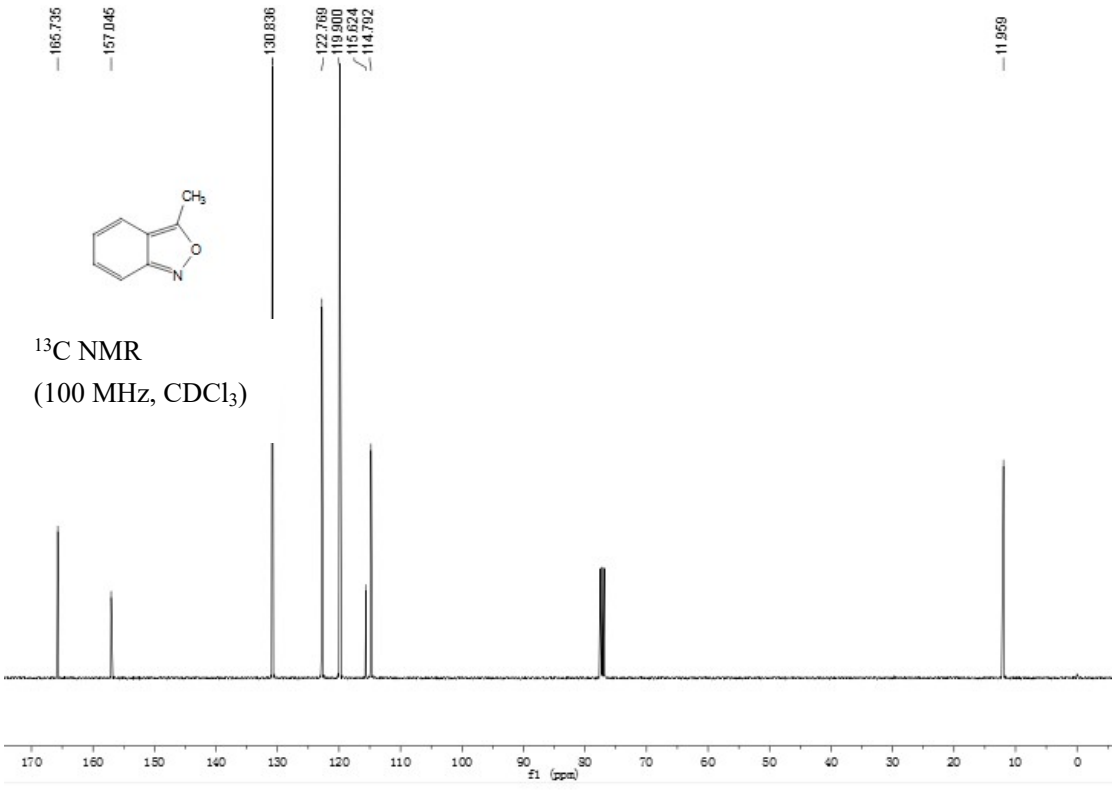


^{13}C NMR
(100 MHz, $CDCl_3$)

(1ae)

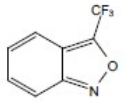


^{1}H NMR
(400 MHz, $CDCl_3$)

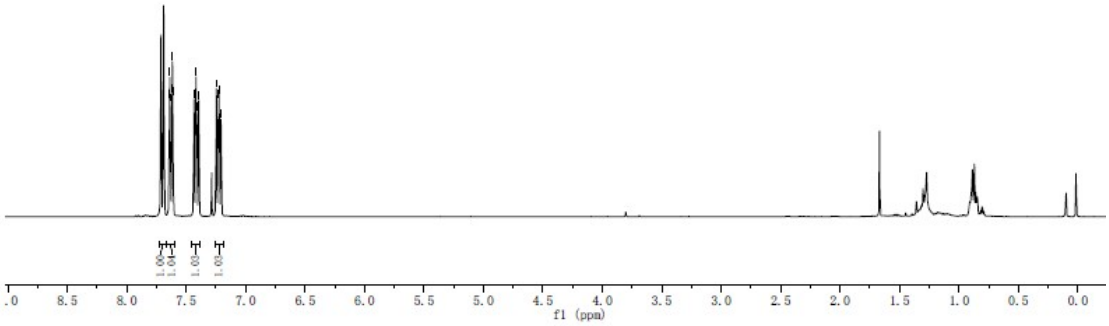


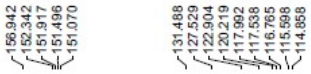
^{13}C NMR
(100 MHz, $CDCl_3$)

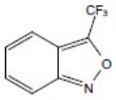
(1af)



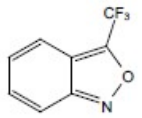
^{1}H NMR
(400 MHz, $CDCl_3$)





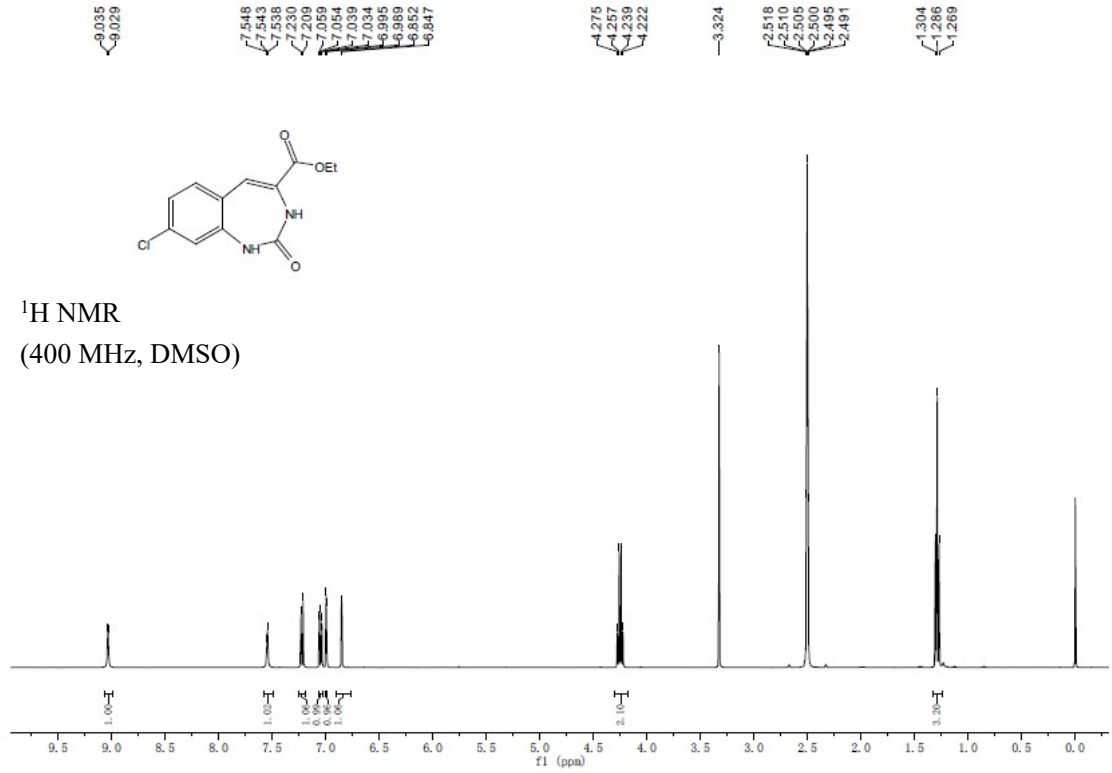


^{13}C NMR
(100 MHz, $CDCl_3$)

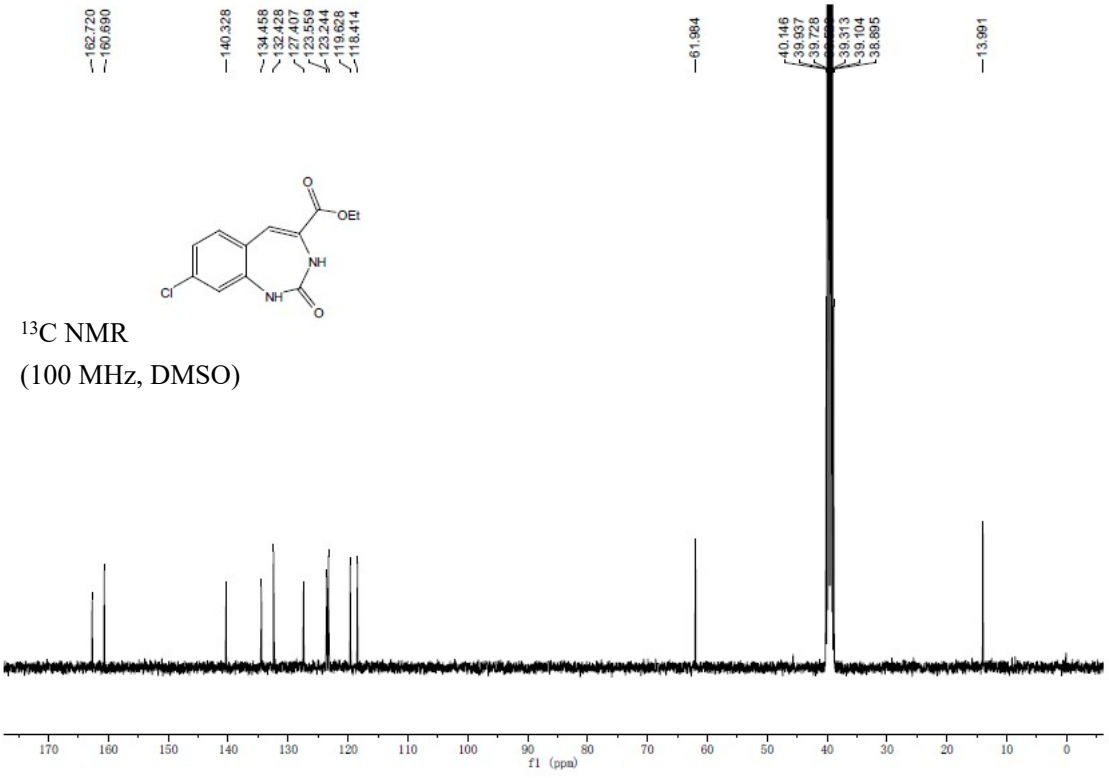


^{19}F NMR
(376 MHZ, $CDCl_3$)

(3a)

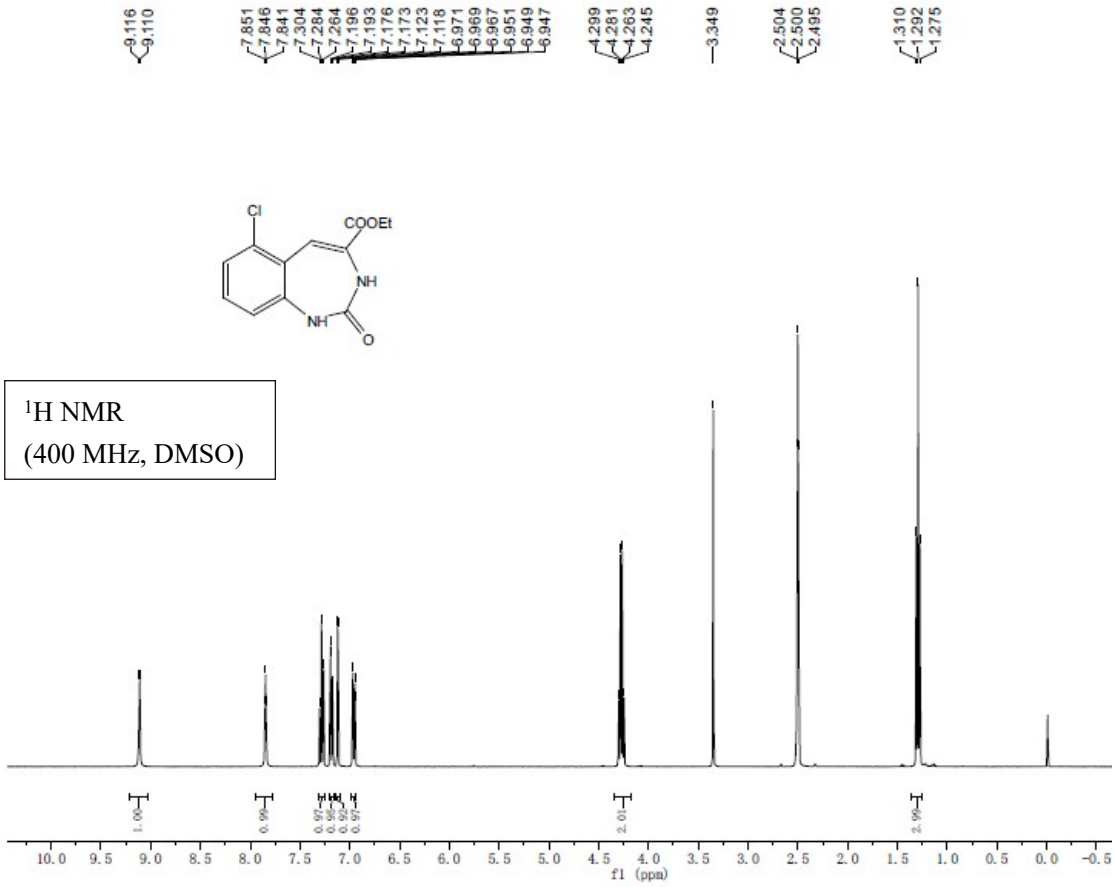


^{1}H NMR
(400 MHz, DMSO)

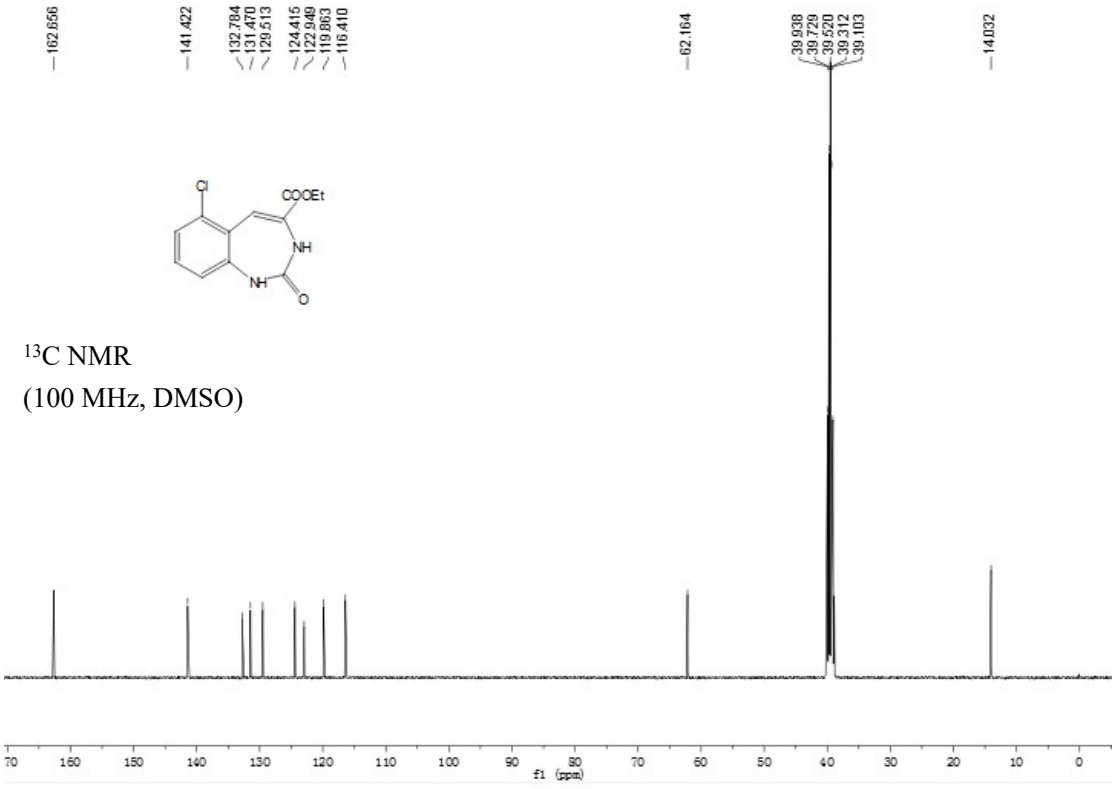


^{13}C NMR
(100 MHz, DMSO)

（3b）

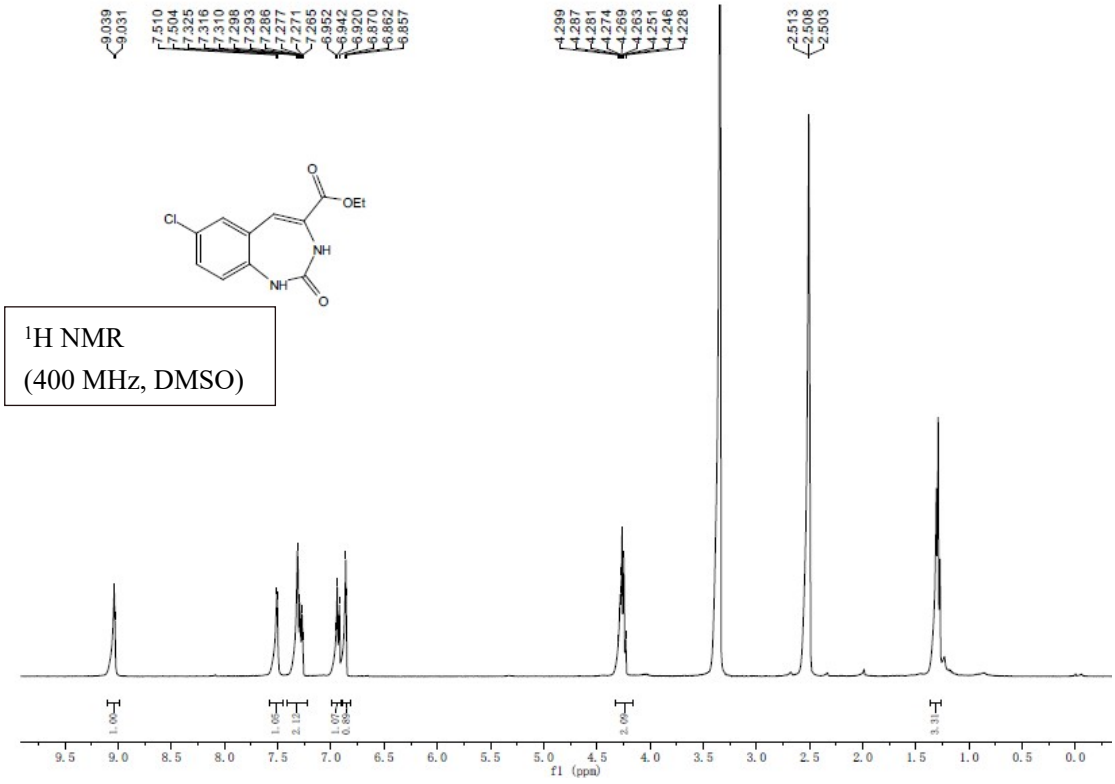


^{1}H NMR
(400 MHz, DMSO)

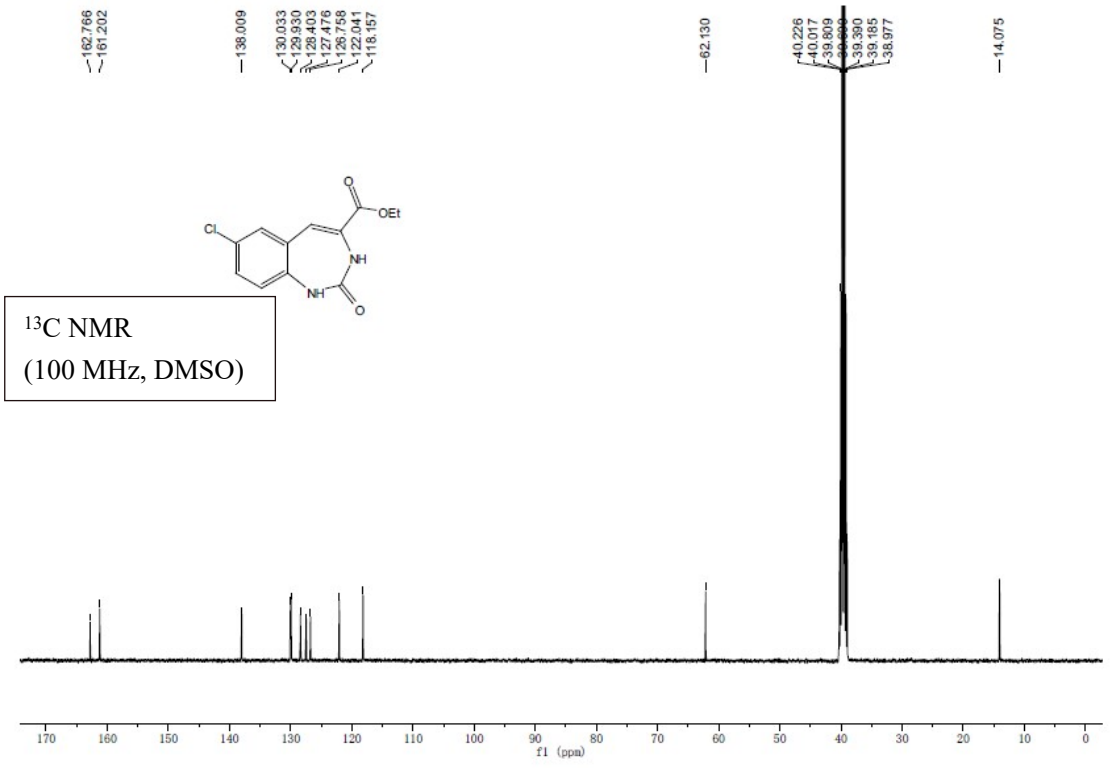


^{13}C NMR
(100 MHz, DMSO)

（3c）

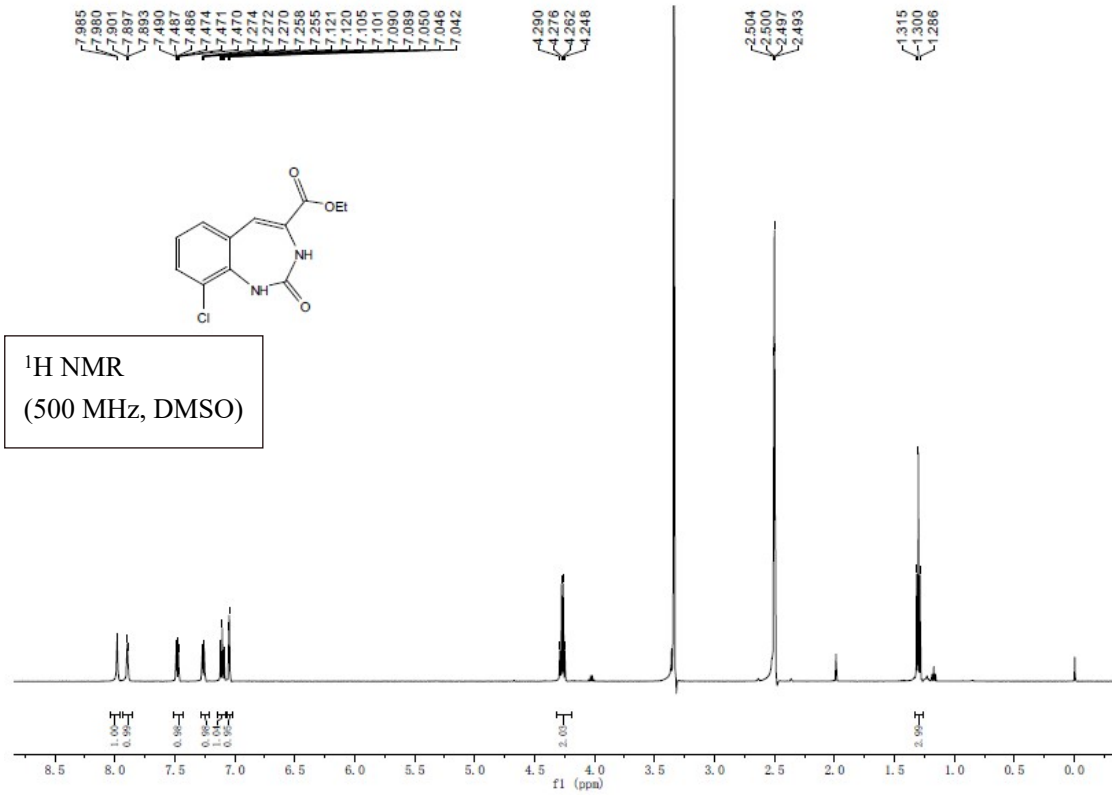


^{1}H NMR
(400 MHz, DMSO)

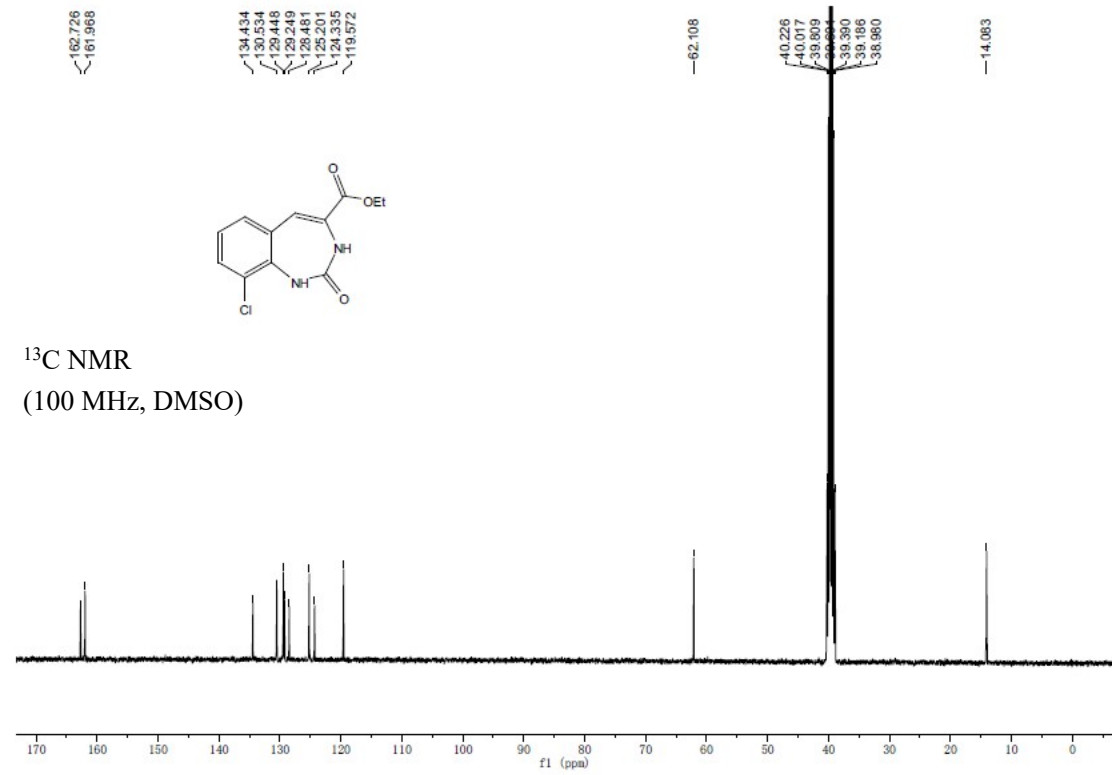


^{13}C NMR
(100 MHz, DMSO)

(3d)

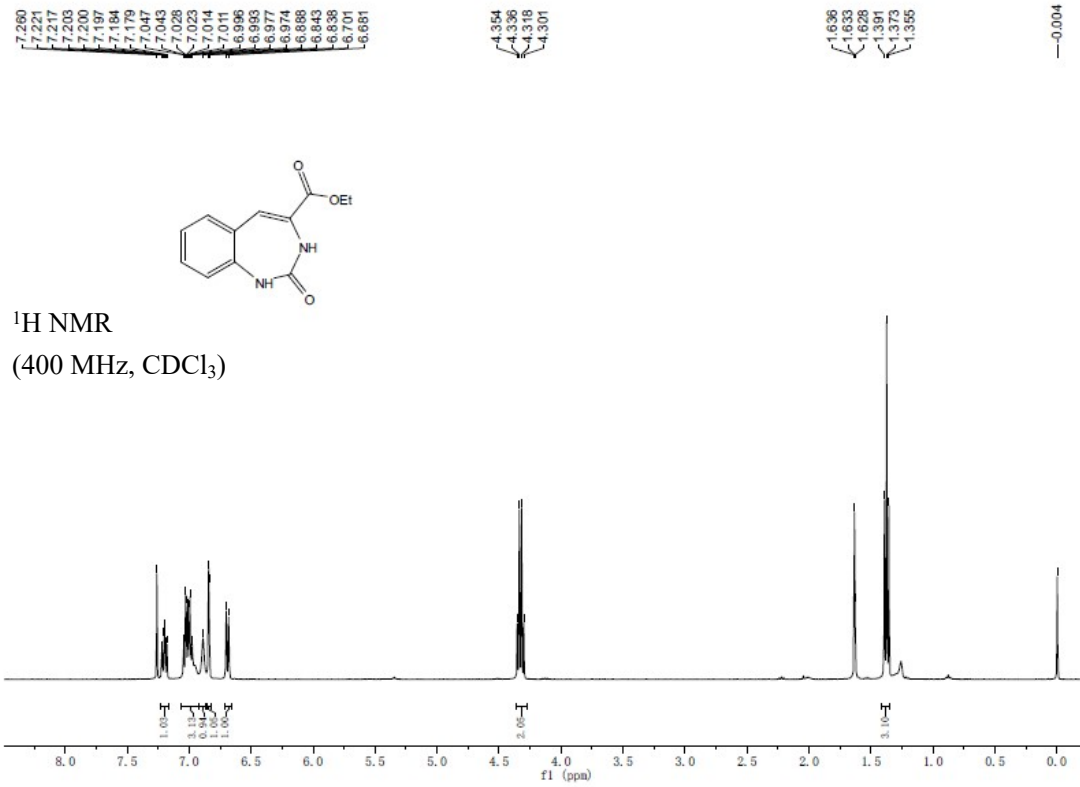


^{1}H NMR
(500 MHz, DMSO)

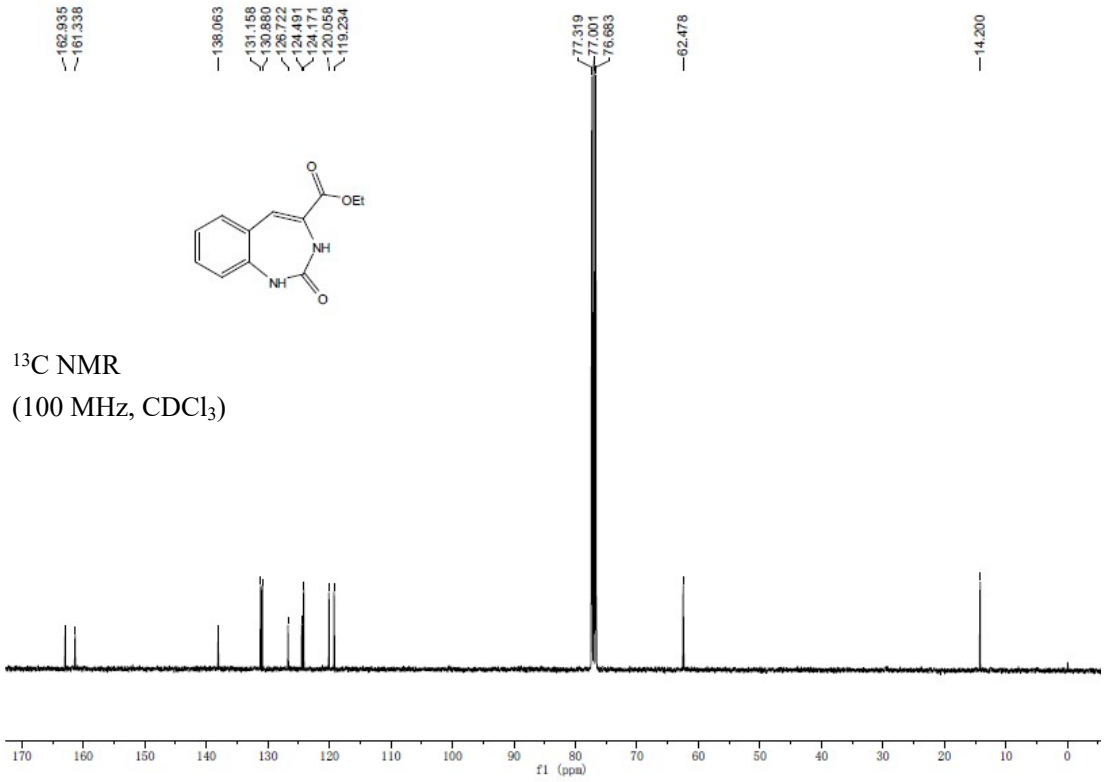


^{13}C NMR
(100 MHz, DMSO)

(3e)

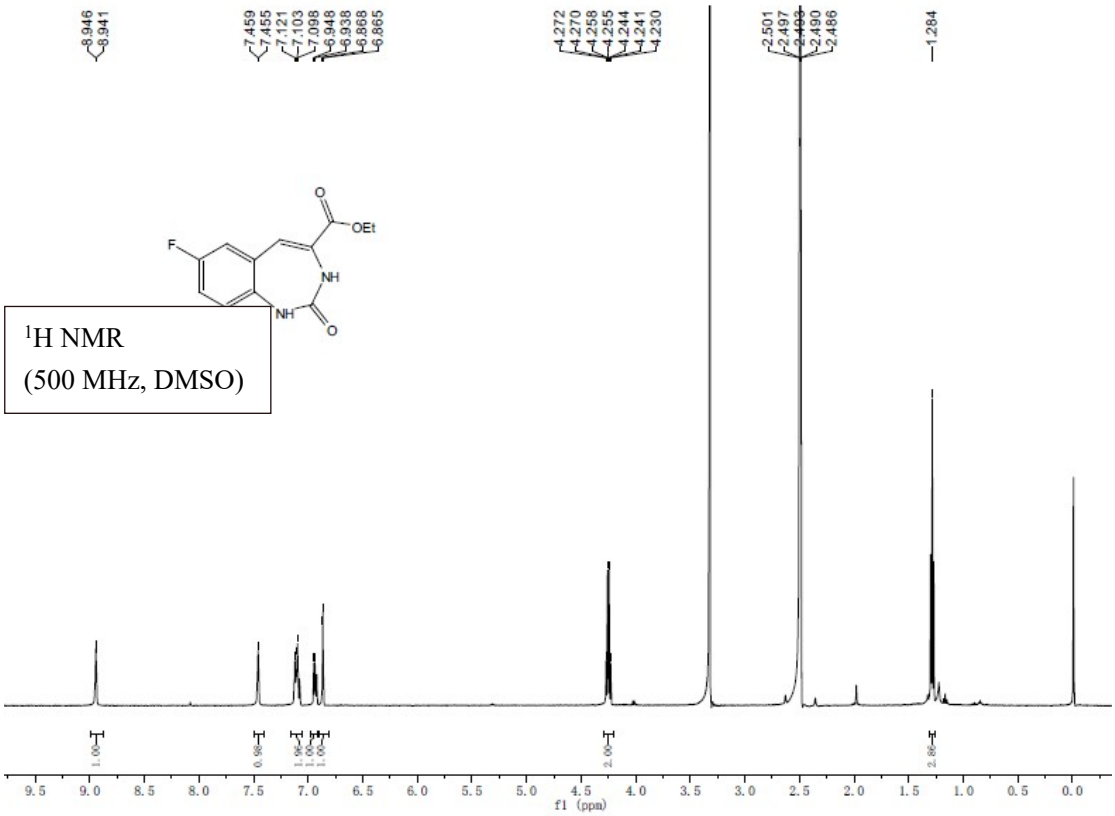


^{1}H NMR
(400 MHz, $CDCl_3$)

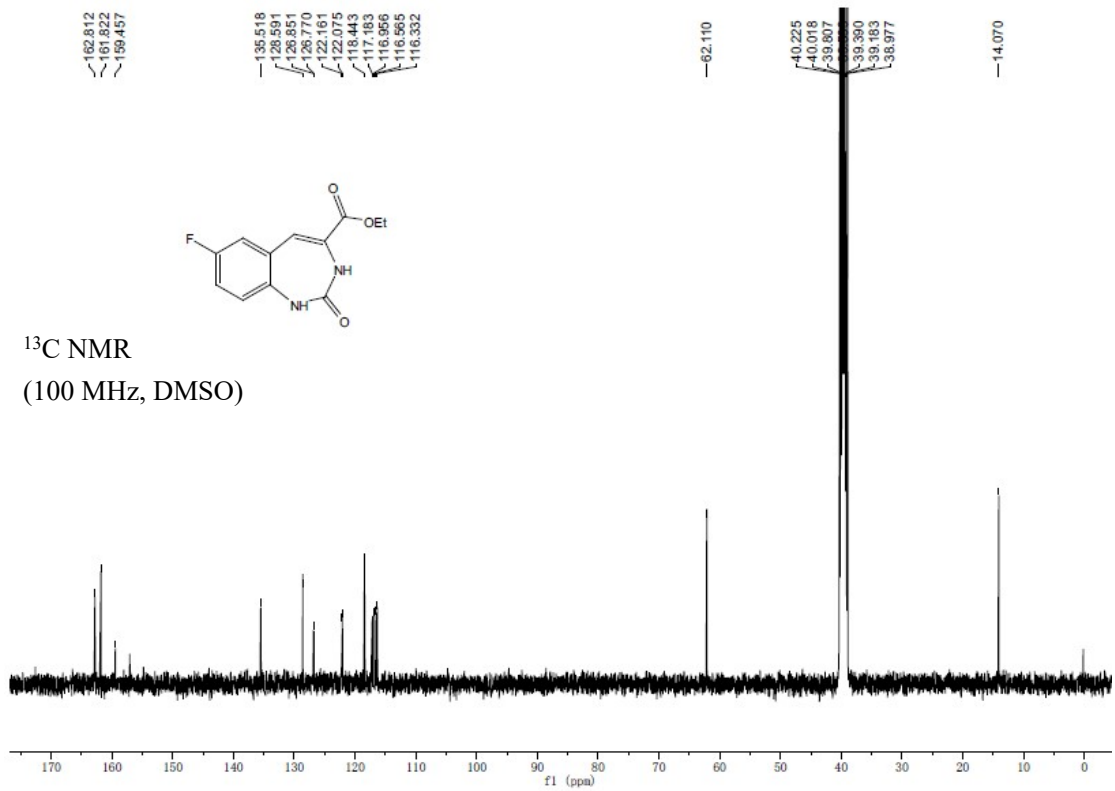


^{13}C NMR
(100 MHz, $CDCl_3$)

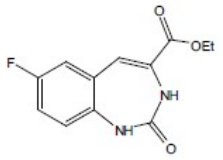
(3f)



^{1}H NMR
(500 MHz, DMSO)



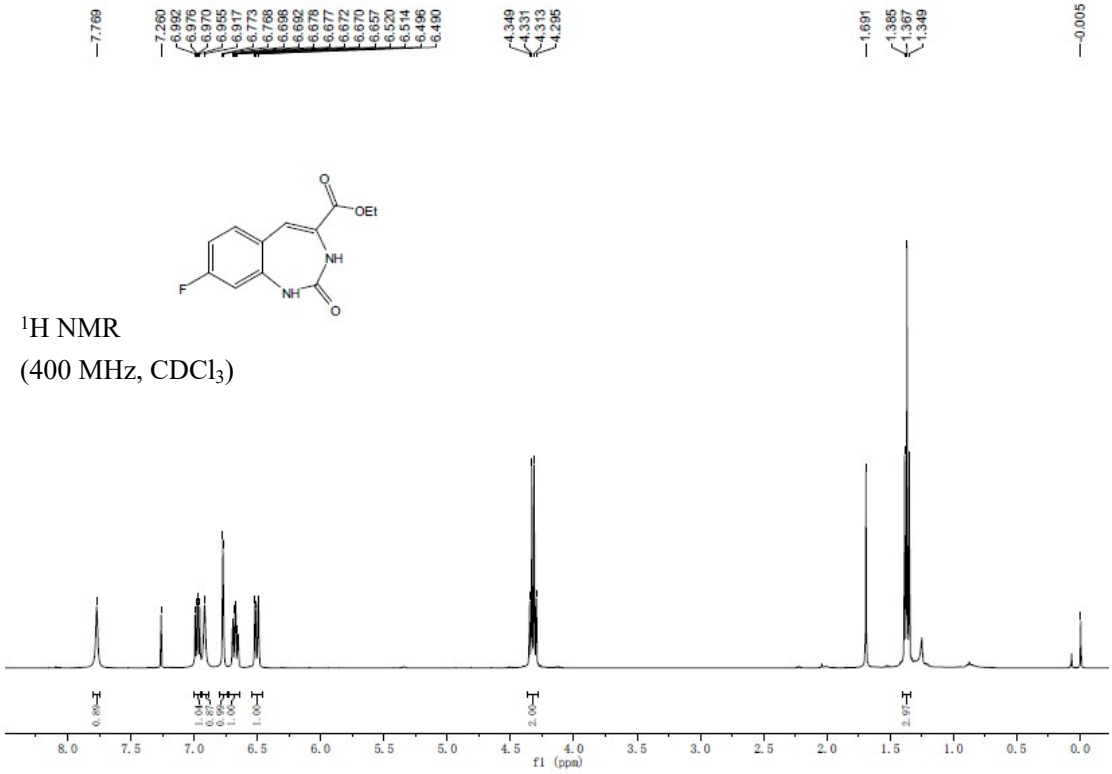
^{13}C NMR
(100 MHz, DMSO)



^{19}F NMR

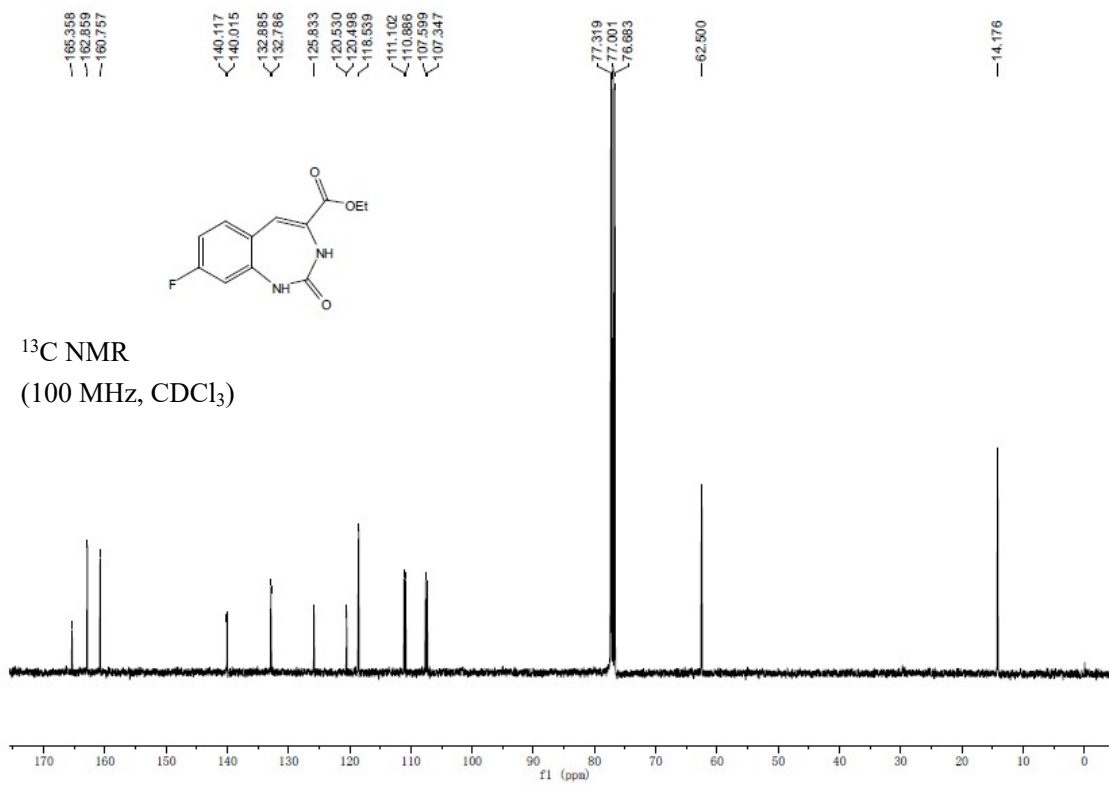
(376 MHZ, DMSO)

(3d)



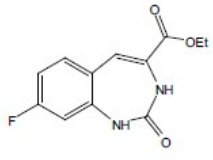
^{1}H NMR

(400 MHz, $CDCl_3$)



^{13}C NMR

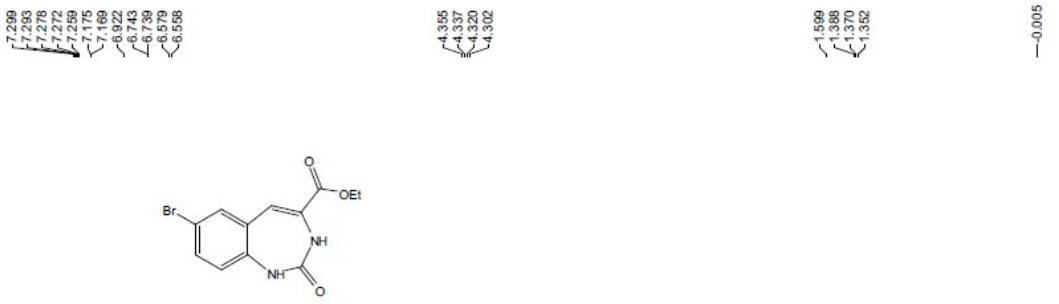
(100 MHz, $CDCl_3$)



^{19}F NMR

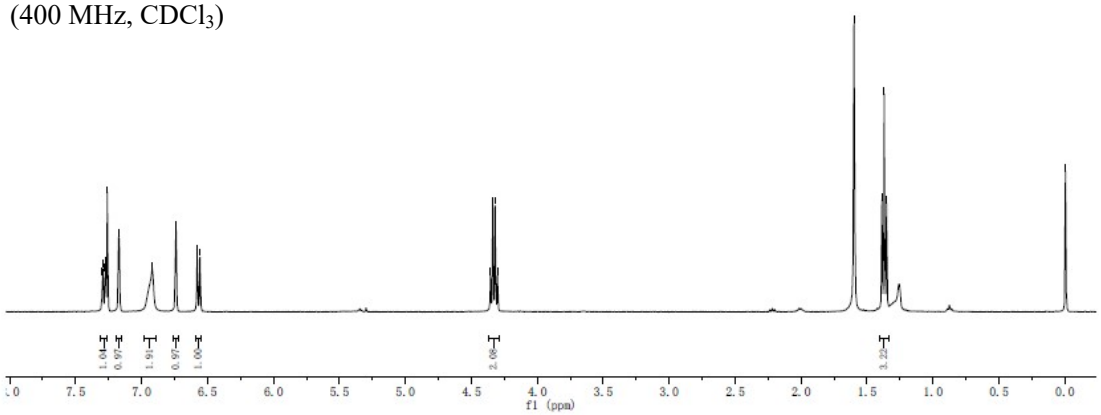
(376 MHZ, $CDCl_3$)

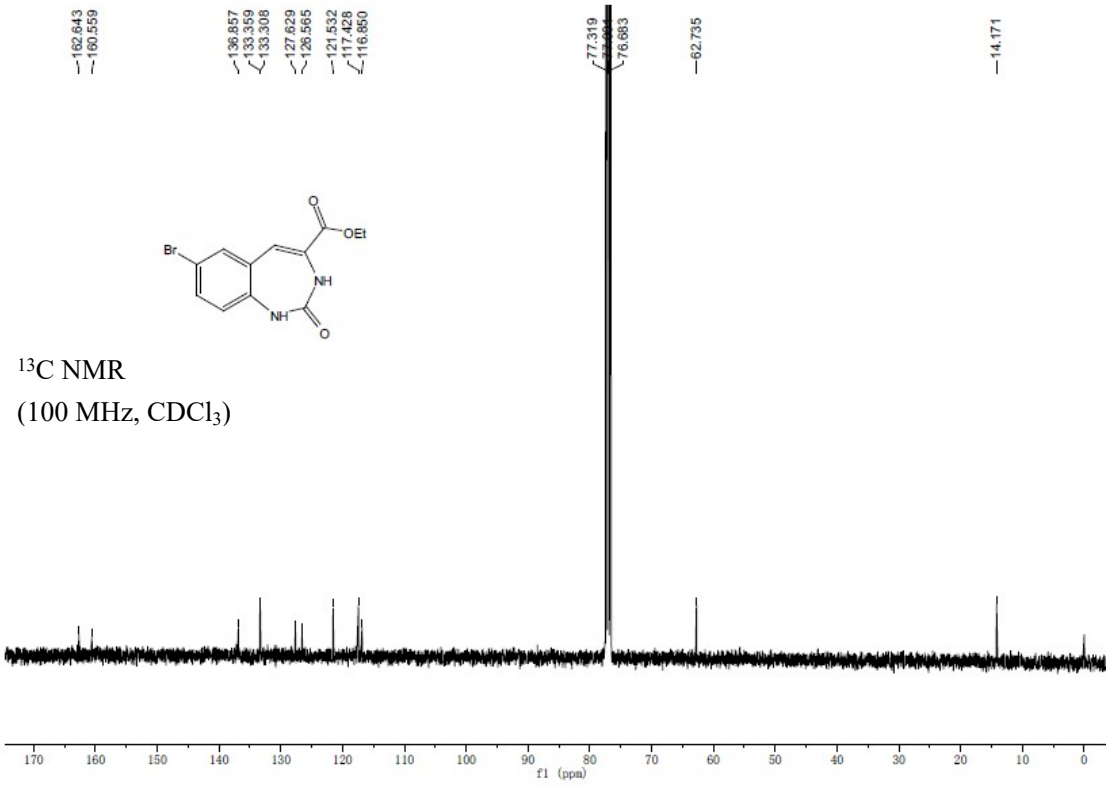
(3h)



^{1}H NMR

(400 MHz, $CDCl_3$)

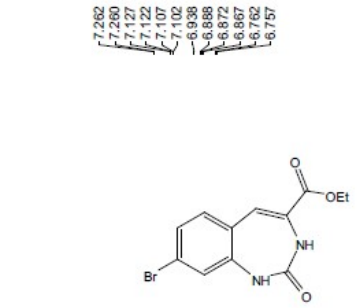




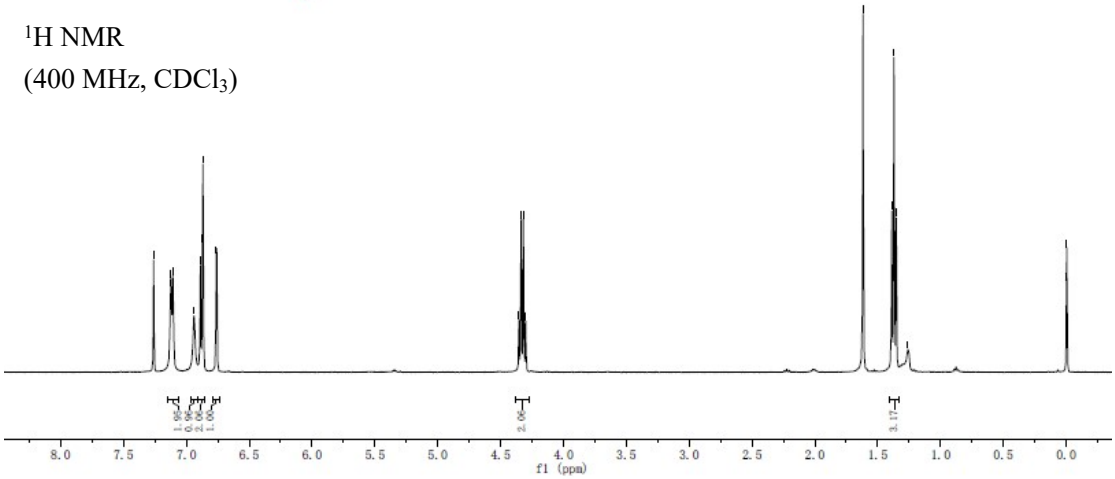
^{13}C NMR

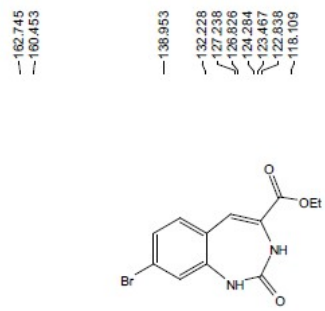
(100 MHz, $CDCl_3$)

(3i)

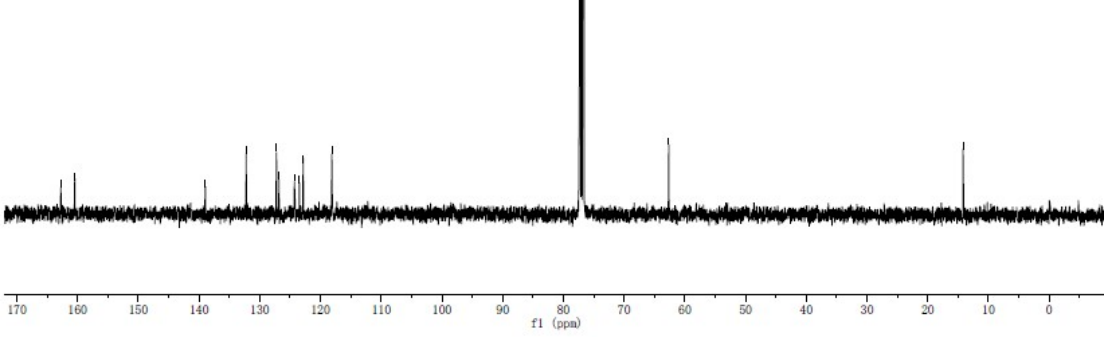


^{1}H NMR
(400 MHz, $CDCl_3$)

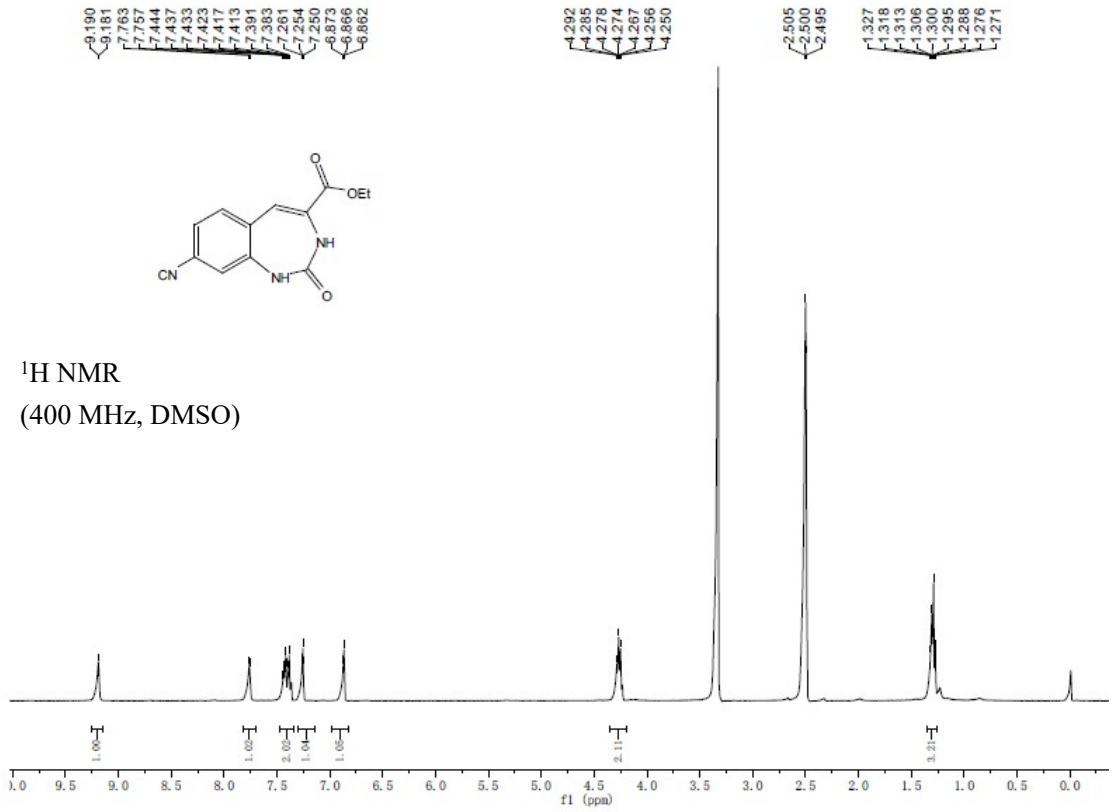




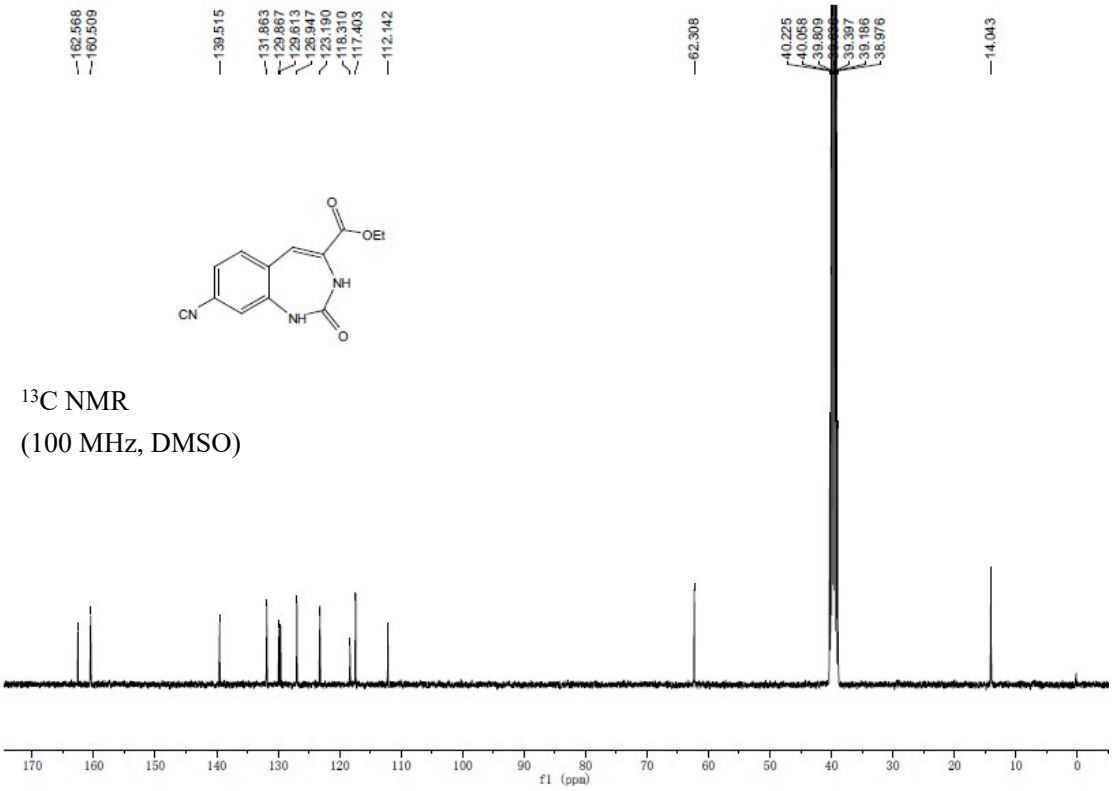
^{13}C NMR
(100 MHz, $CDCl_3$)



(3j)

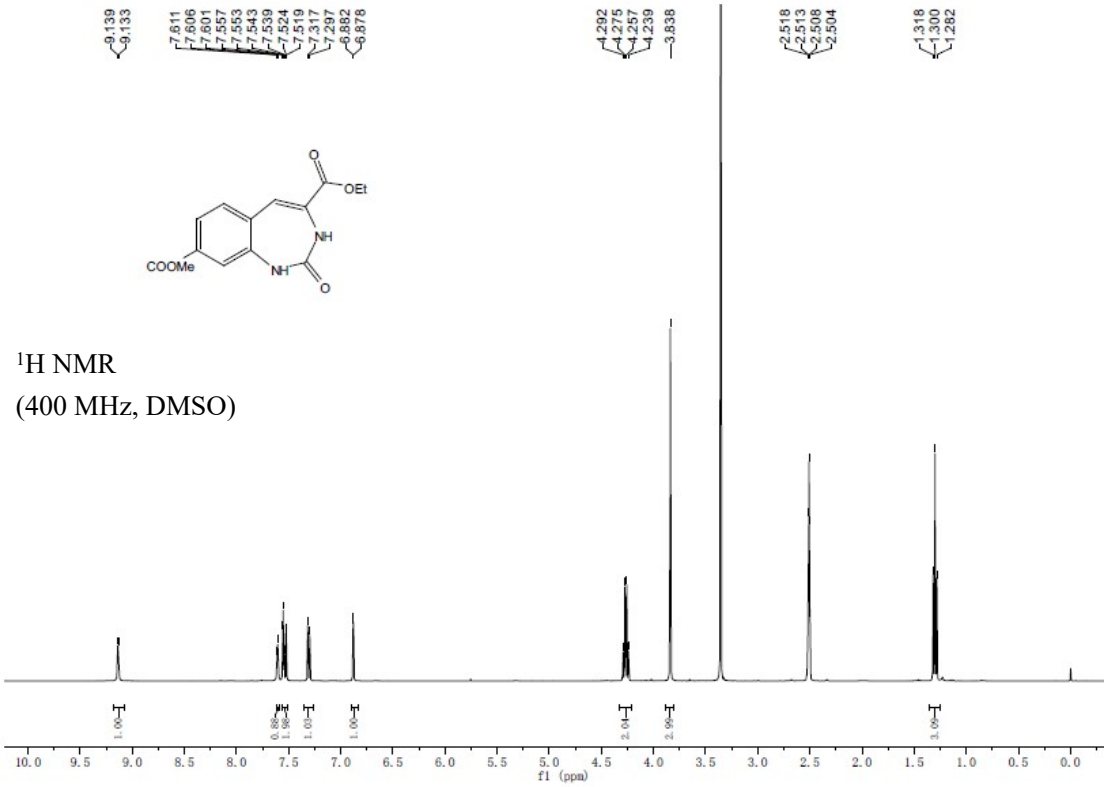


^{1}H NMR
(400 MHz, DMSO)

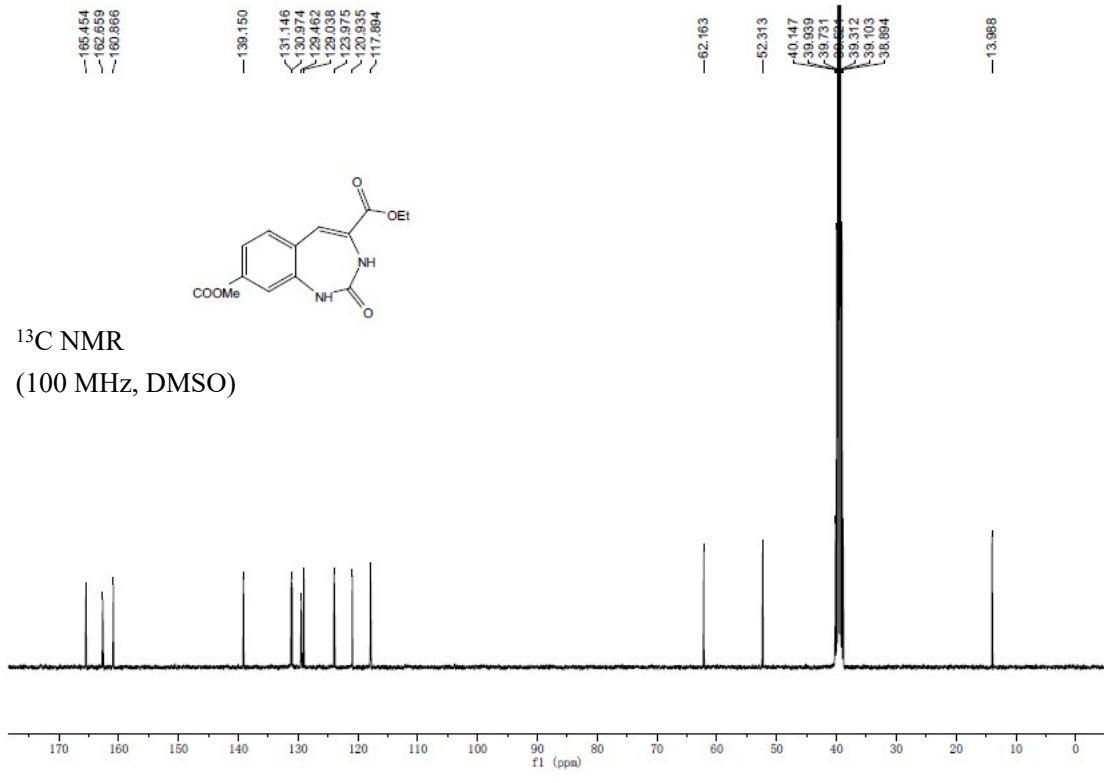


^{13}C NMR
(100 MHz, DMSO)

(3k)

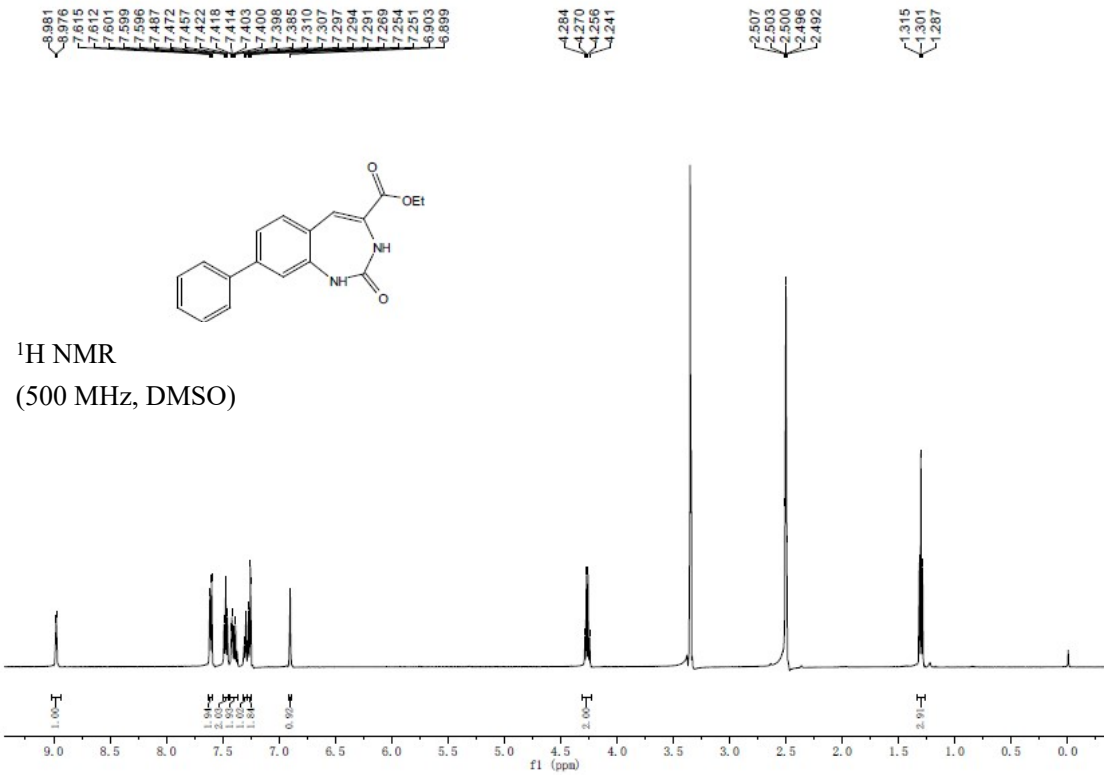


^{1}H NMR
(400 MHz, DMSO)



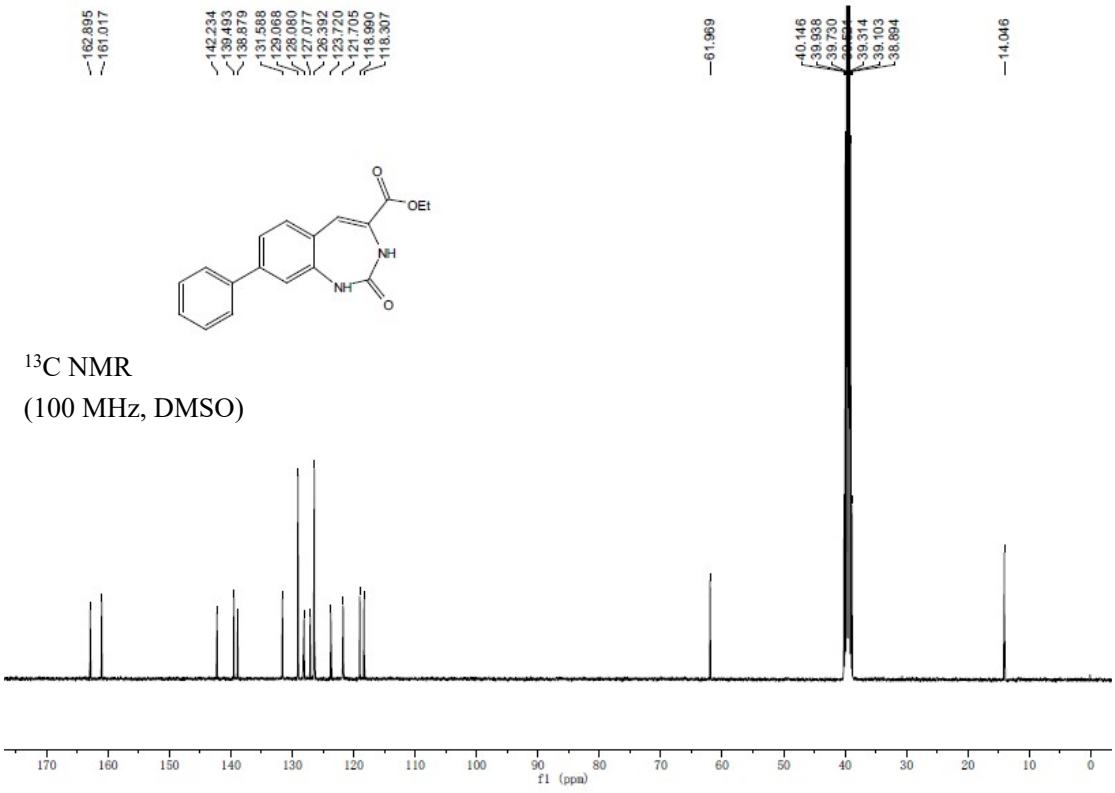
^{13}C NMR
(100 MHz, DMSO)

(3l)



^{1}H NMR

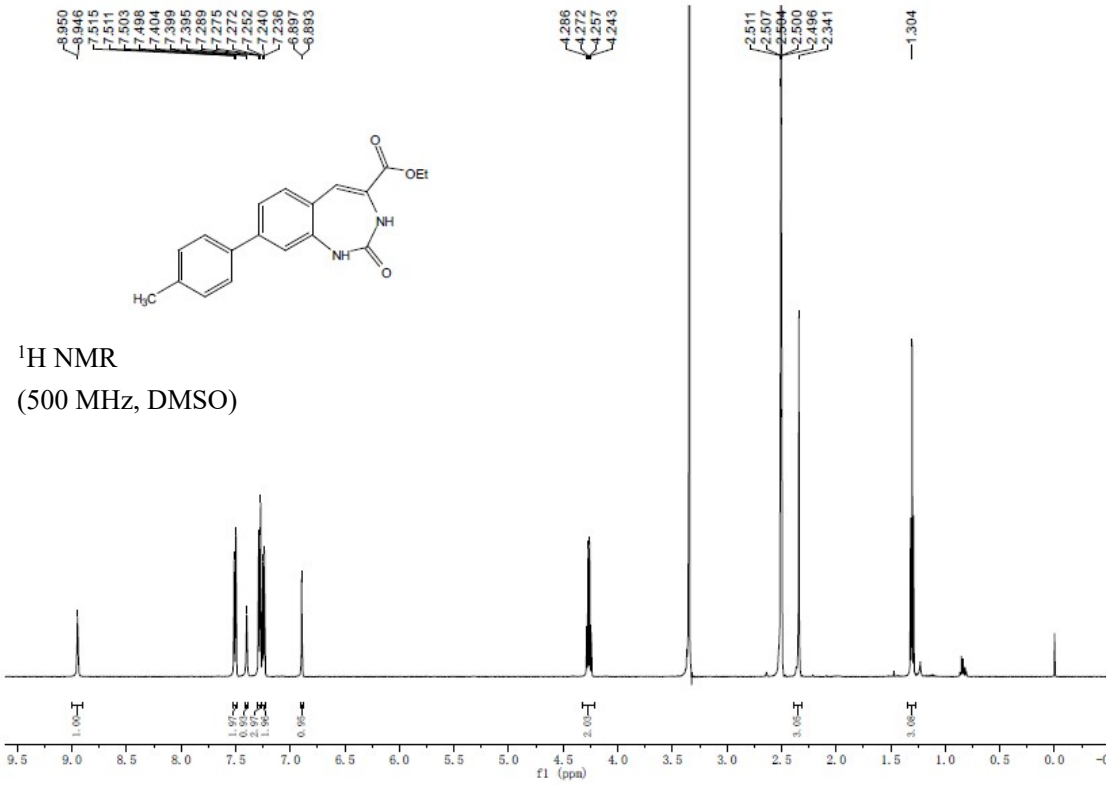
(500 MHz, DMSO)



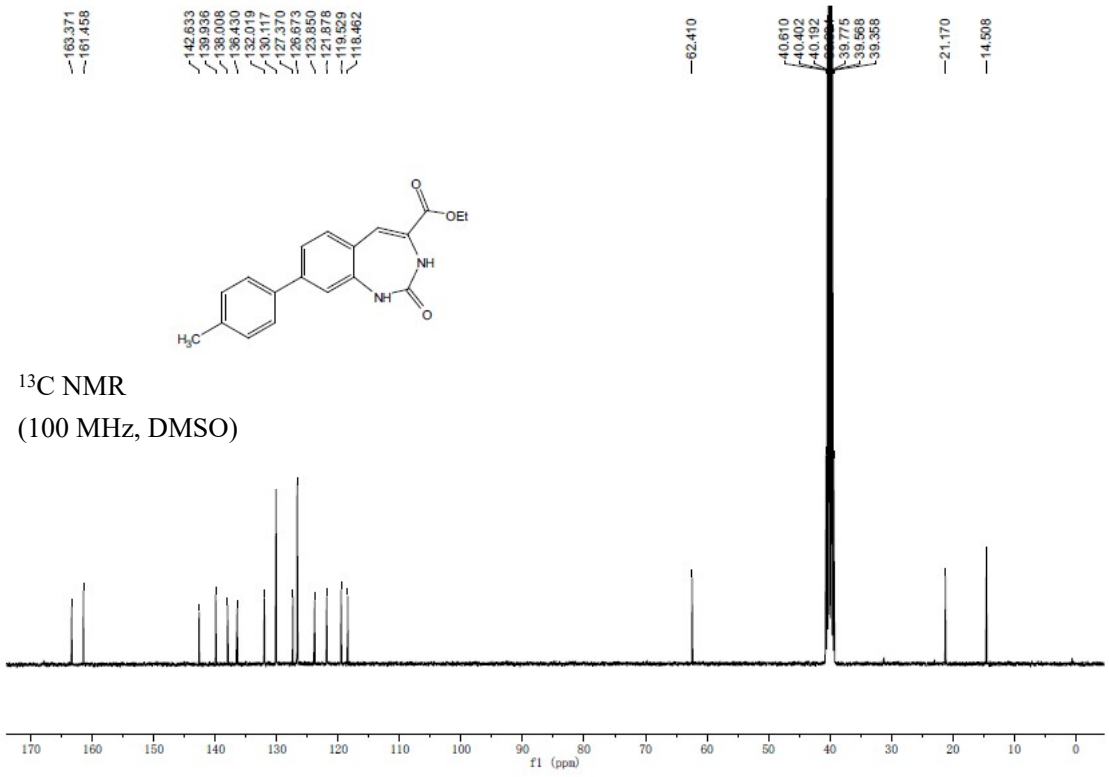
^{13}C NMR

(100 MHz, DMSO)

(3m)

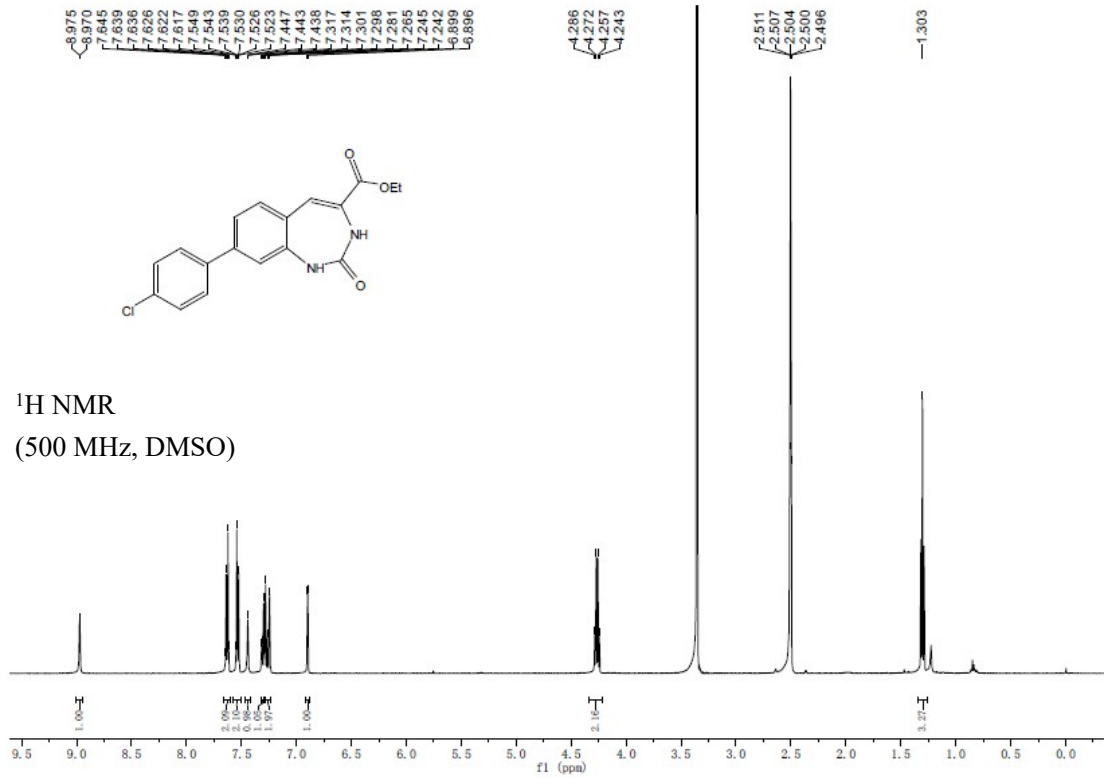


^{1}H NMR
(500 MHz, DMSO)

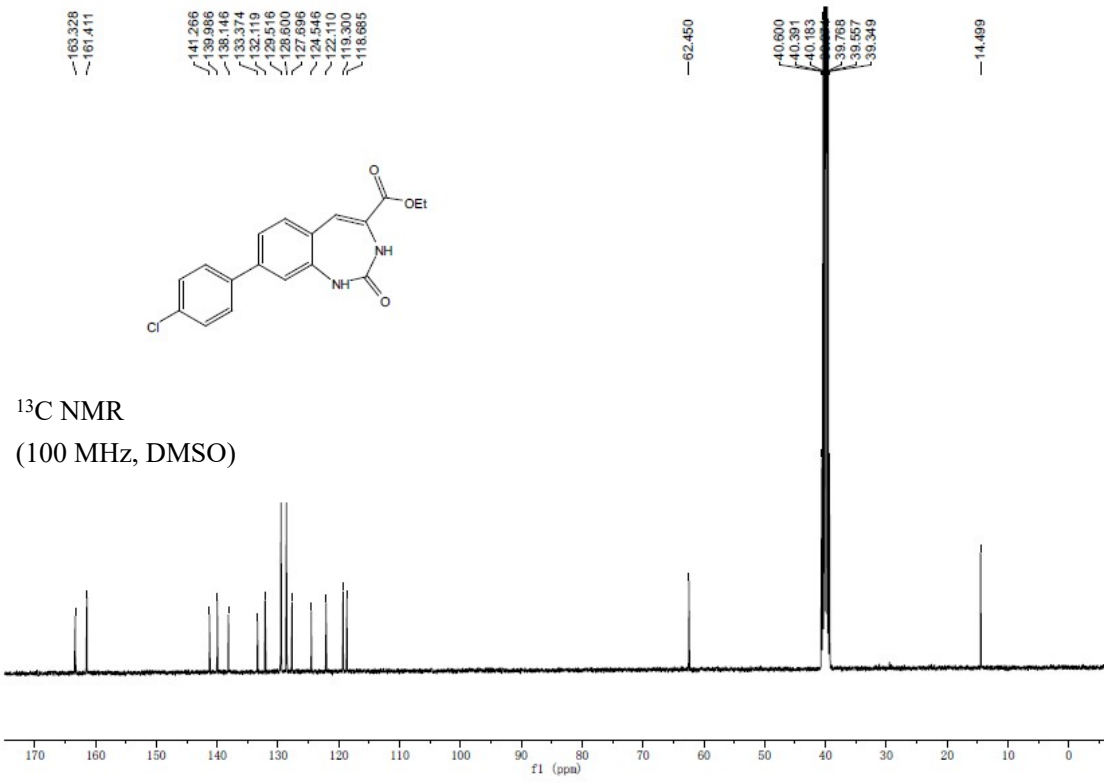


^{13}C NMR
(100 MHz, DMSO)

(3n)

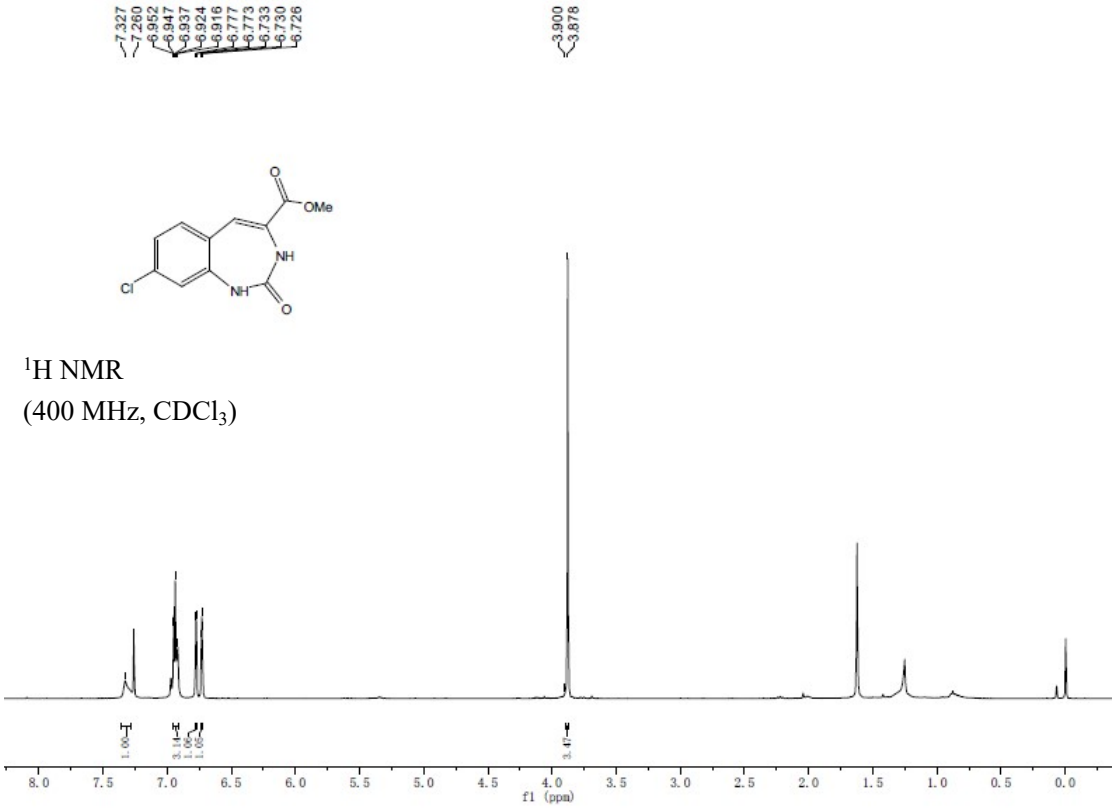


^{1}H NMR
(500 MHz, DMSO)

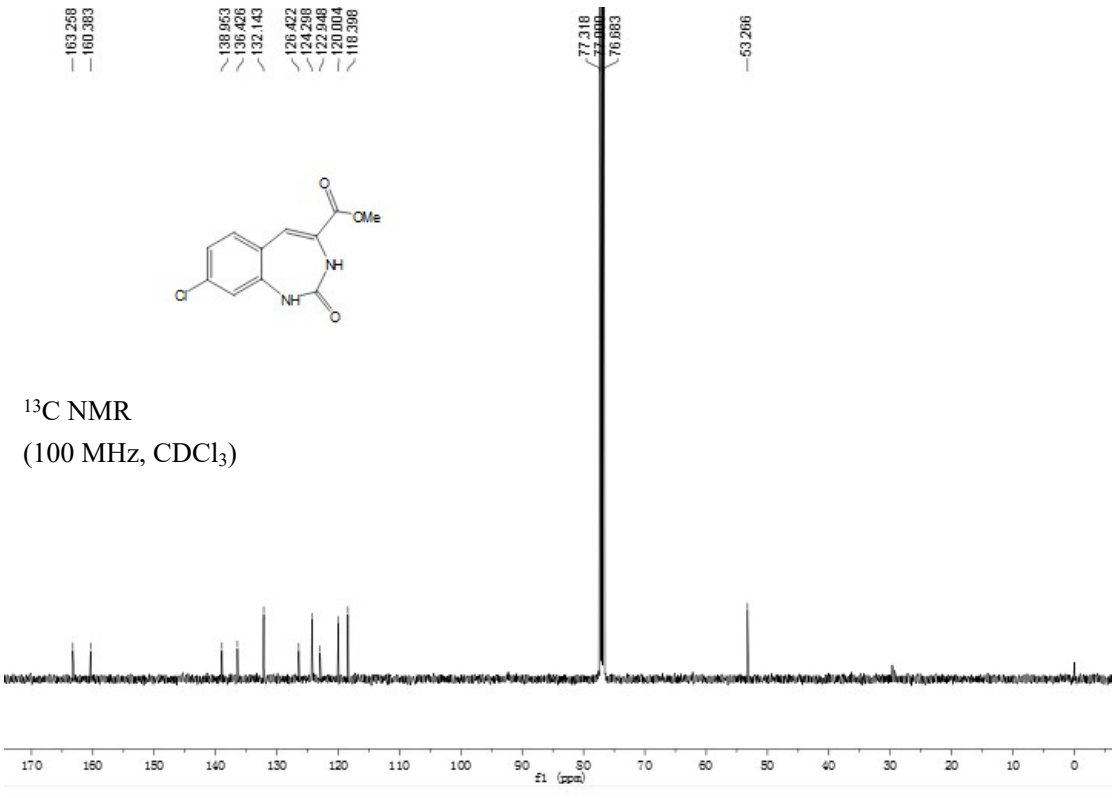


^{13}C NMR
(100 MHz, DMSO)

(3o)

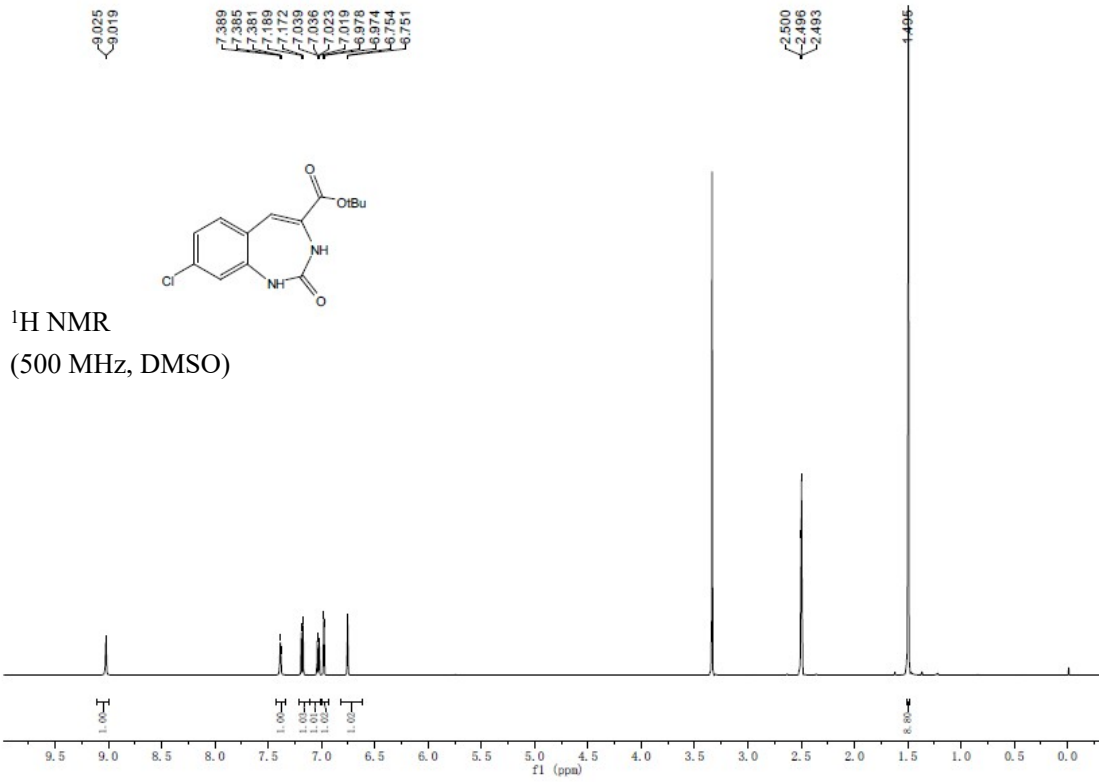


^{1}H NMR
(400 MHz, $CDCl_3$)

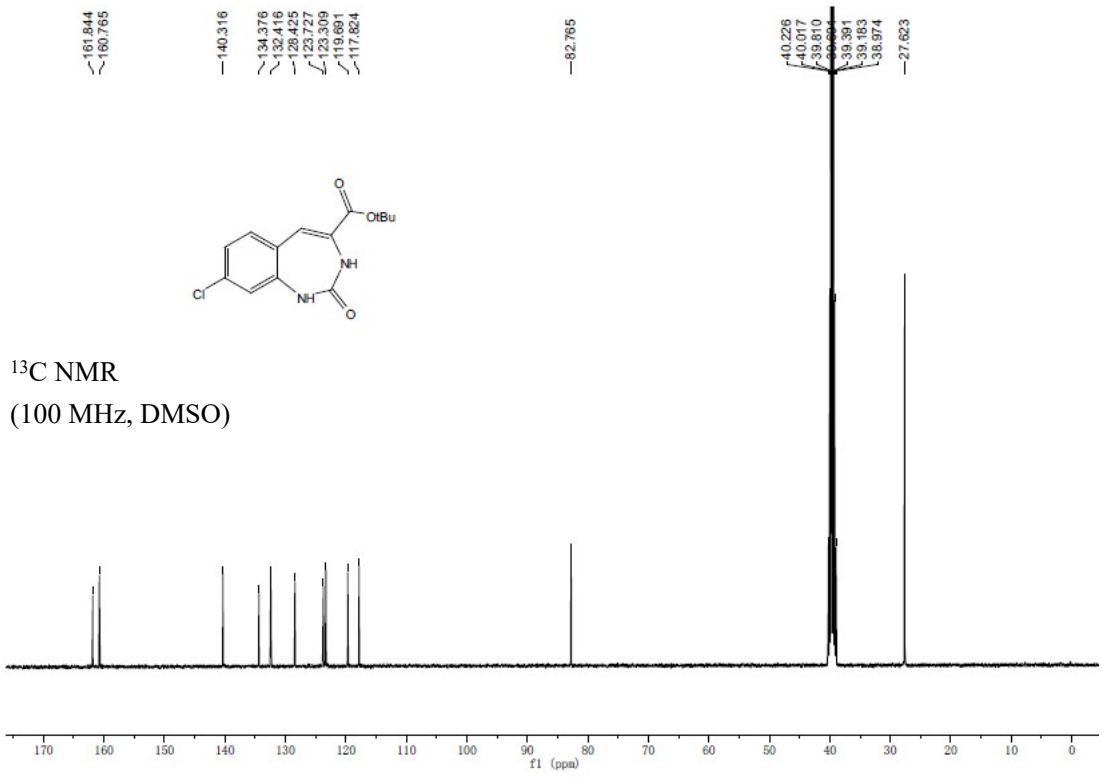


^{13}C NMR
(100 MHz, $CDCl_3$)

(3p)

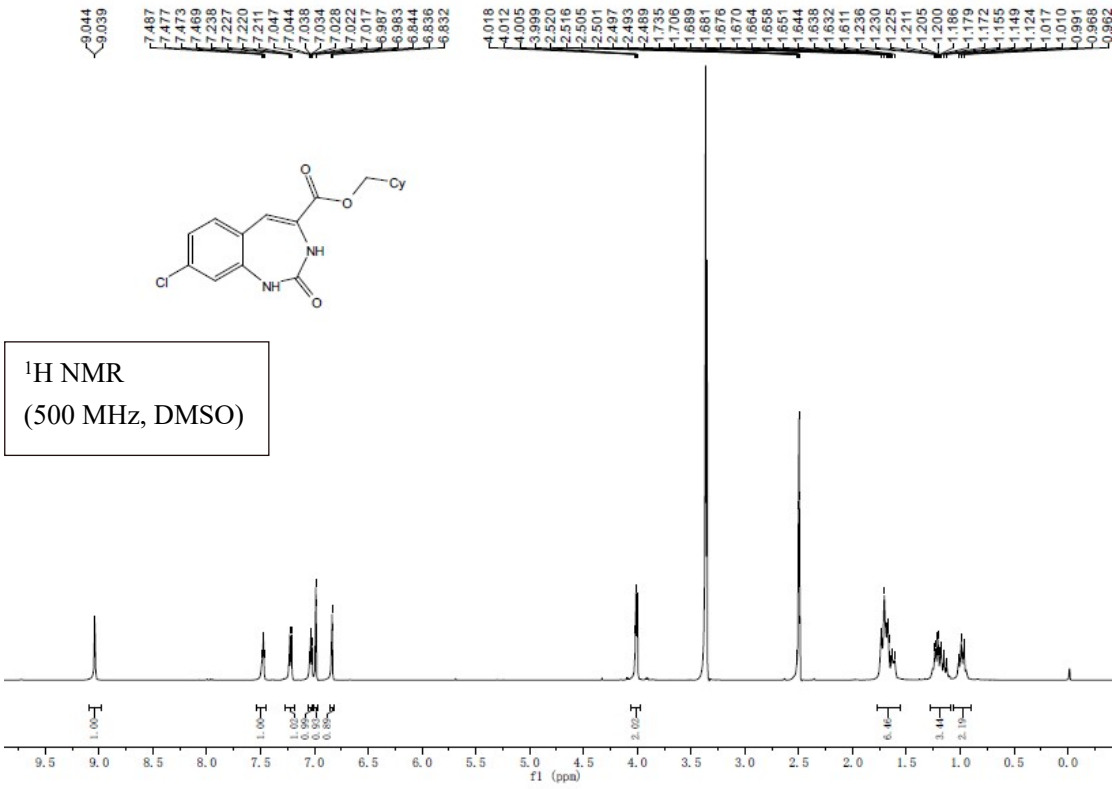


^{1}H NMR
(500 MHz, DMSO)

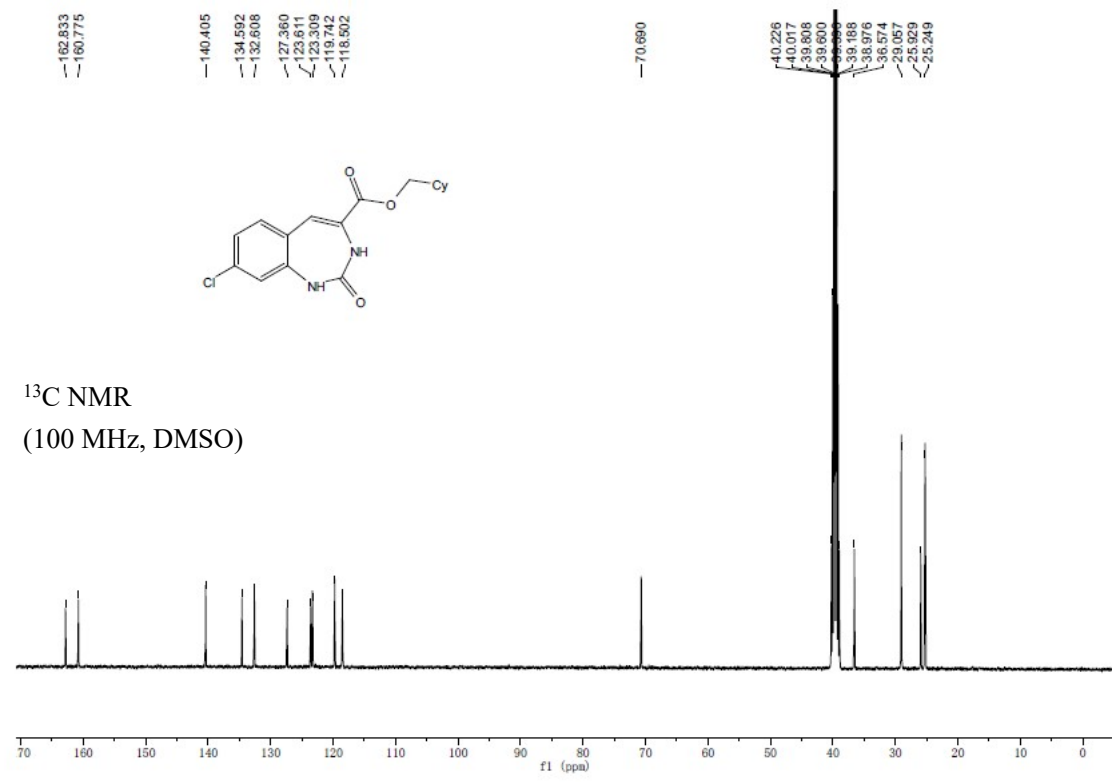


^{13}C NMR
(100 MHz, DMSO)

(3q)

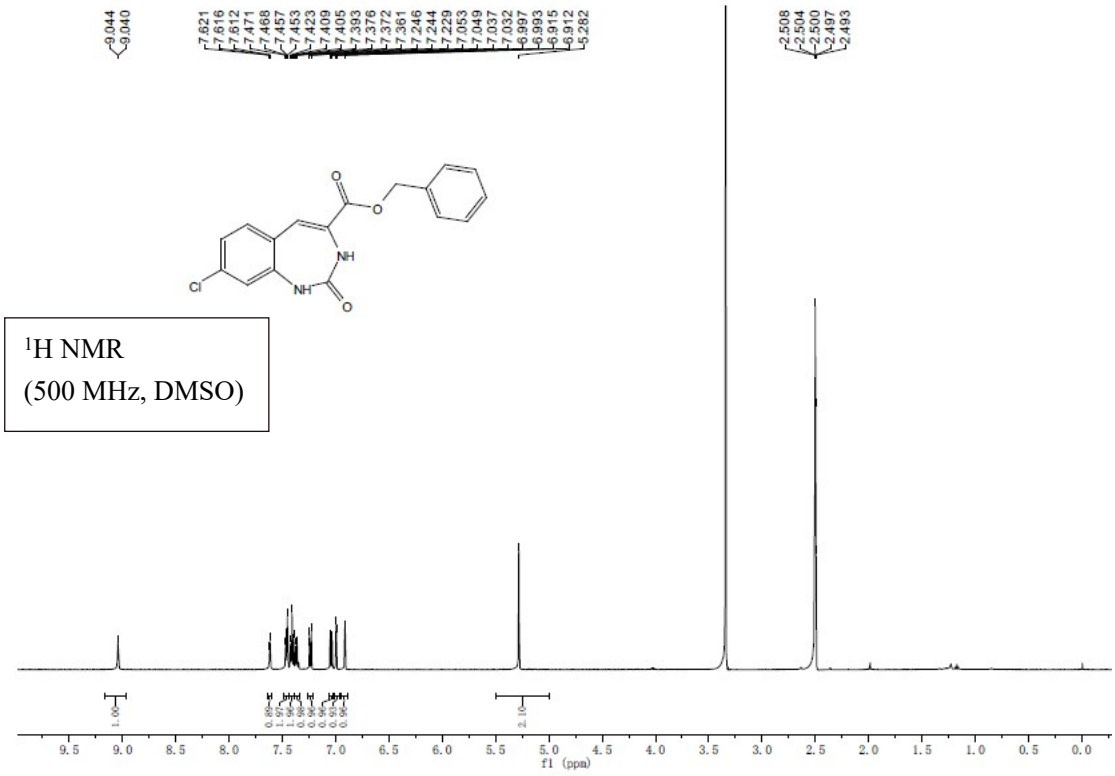


^{1}H NMR
(500 MHz, DMSO)

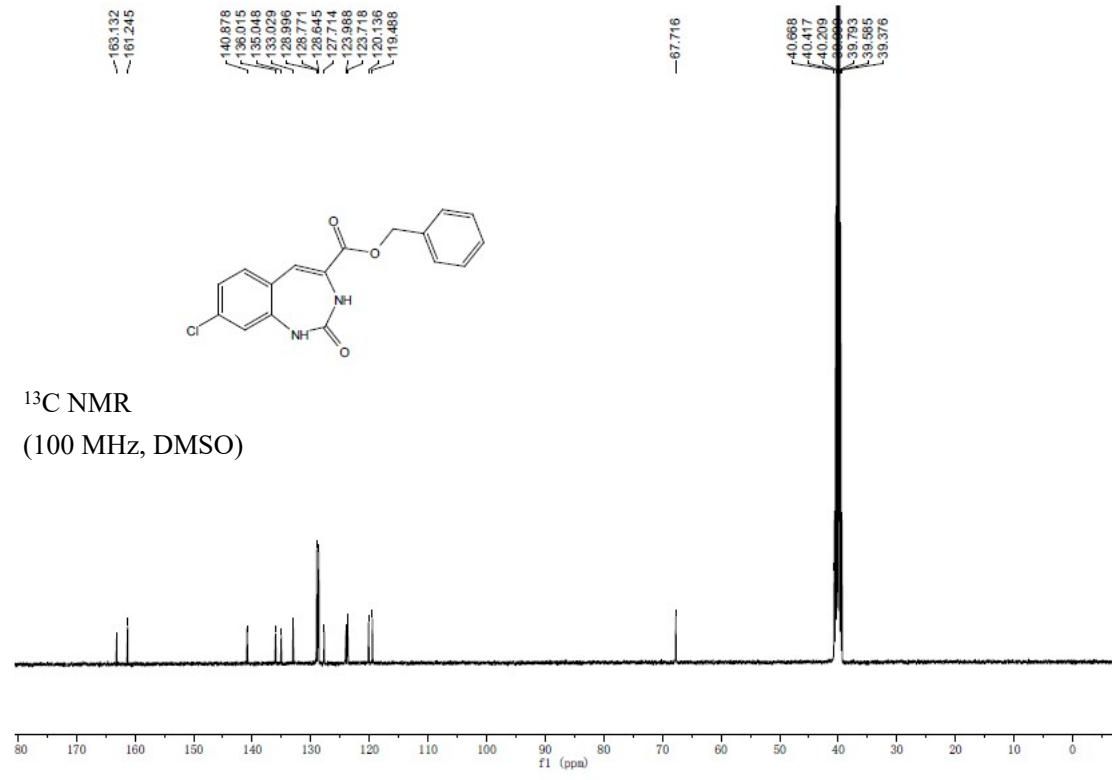


^{13}C NMR
(100 MHz, DMSO)

(3r)

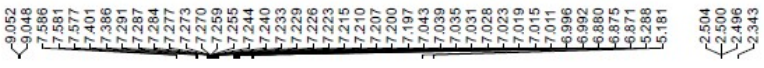


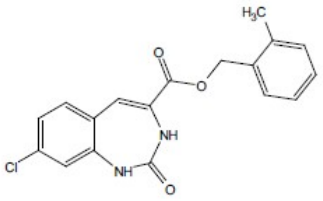
^{1}H NMR
(500 MHz, DMSO)



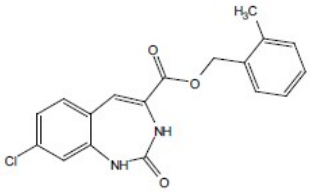
^{13}C NMR
(100 MHz, DMSO)

(3s)

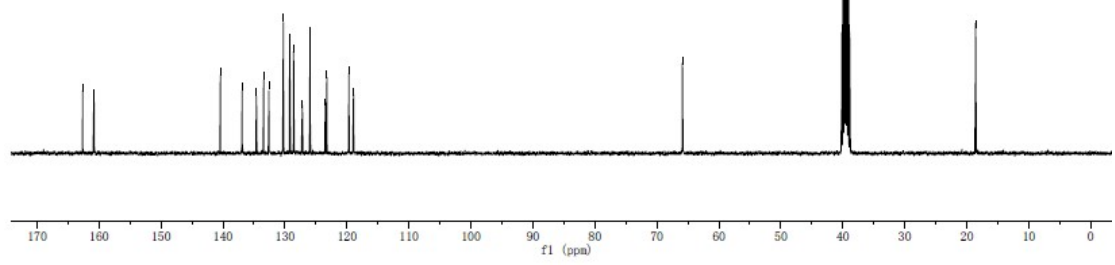




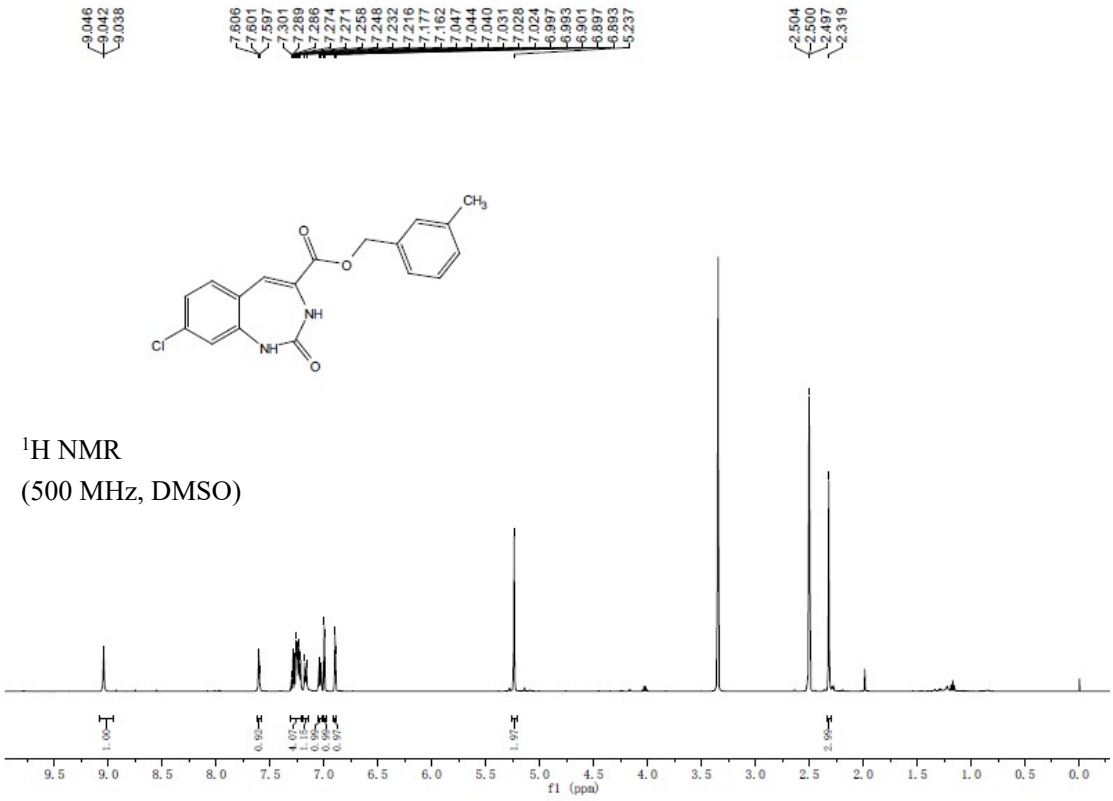
^{1}H NMR
(500 MHz, DMSO)



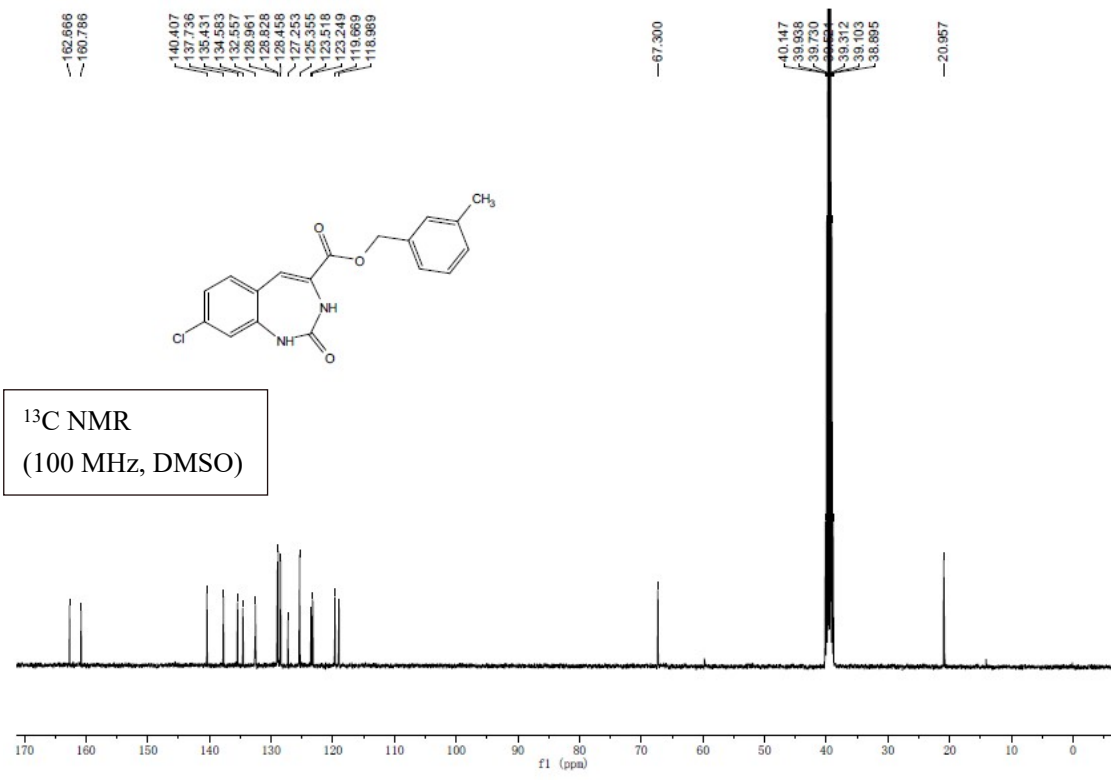
^{13}C NMR
(100 MHz, DMSO)



(3t)

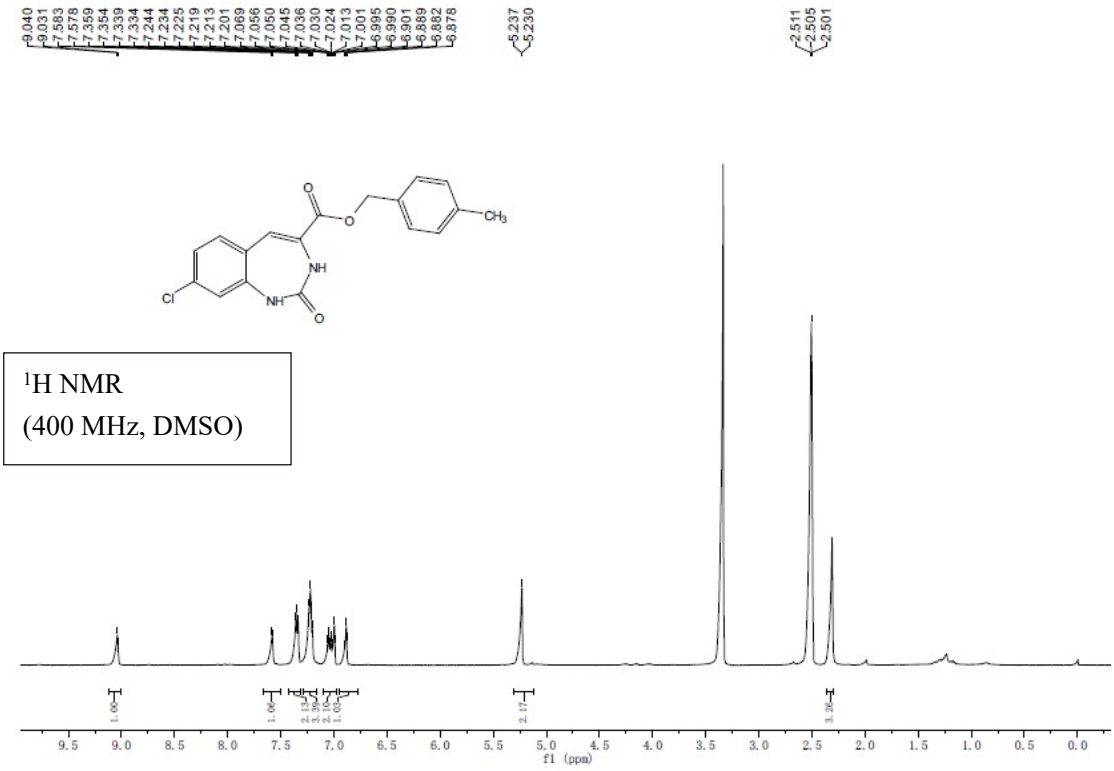


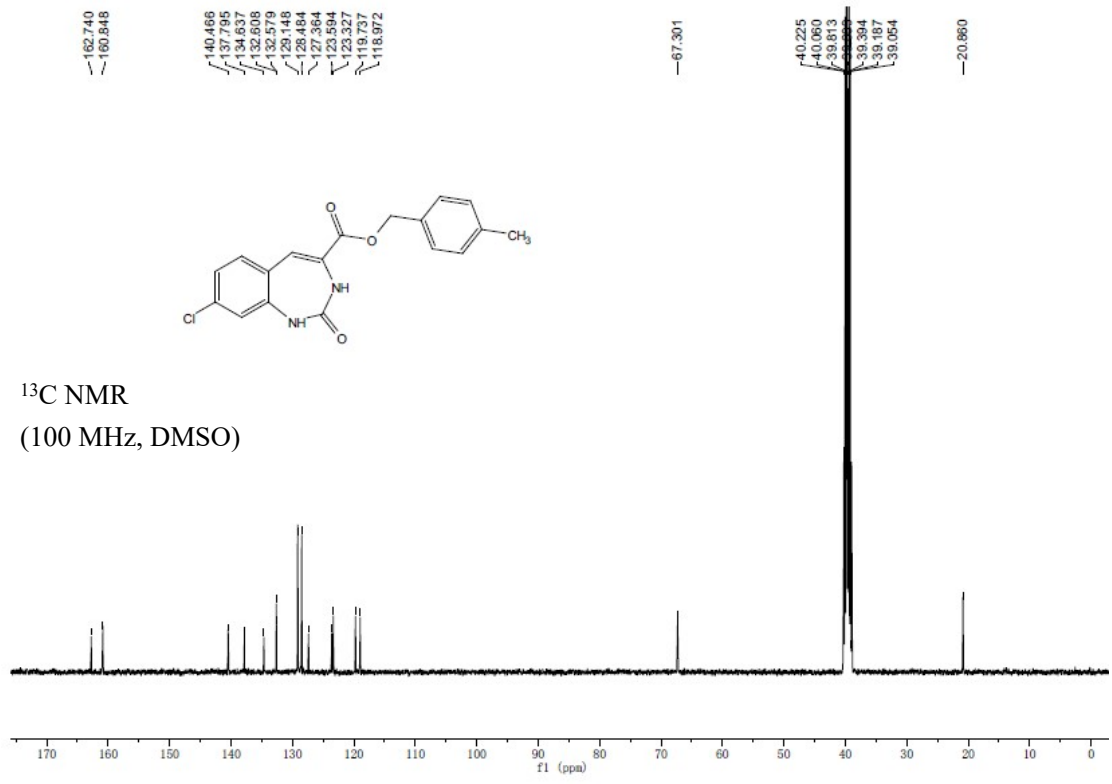
^{1}H NMR
(500 MHz, DMSO)



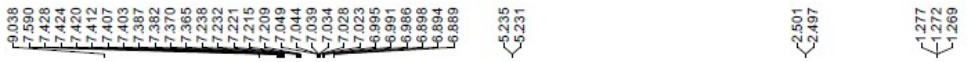
^{13}C NMR
(100 MHz, DMSO)

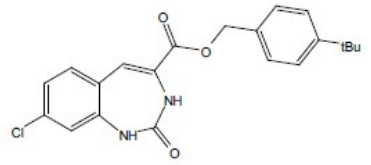
(3u)


9.040
9.031
7.583
7.578
7.359
7.354
7.339
7.334
7.244
7.234
7.225
7.219
7.213
7.201
7.069
7.056
7.050
7.045
7.036
7.030
7.024
7.013
7.001
6.995
6.990
6.901
6.889
6.882
6.878
5.237
5.230
2.511
2.505
2.501
O
O
CH3
NH
Cl
NH
O
1H NMR
(400 MHz, DMSO)
f1 (ppm)


162.740
160.848
140.466
137.795
134.637
132.608
132.579
129.148
128.484
127.364
123.594
123.327
119.737
118.972
67.301
40.225
40.060
39.813
39.394
39.187
39.054
20.860
O
O
CH3
NH
Cl
NH
O
13C NMR
(100 MHz, DMSO)
f1 (ppm)

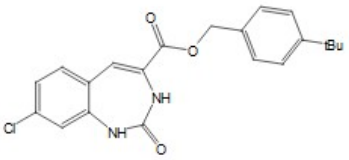
(3v)





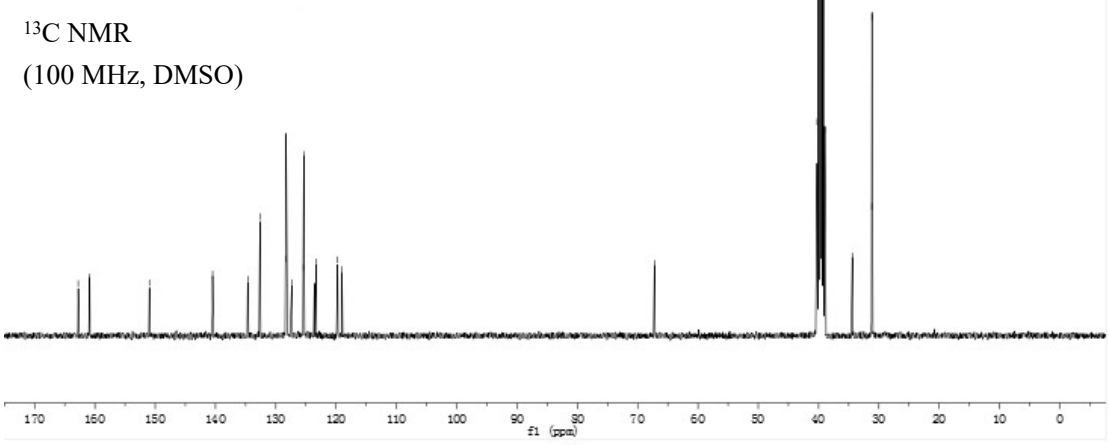
^{1}H NMR

(500 MHz, DMSO)

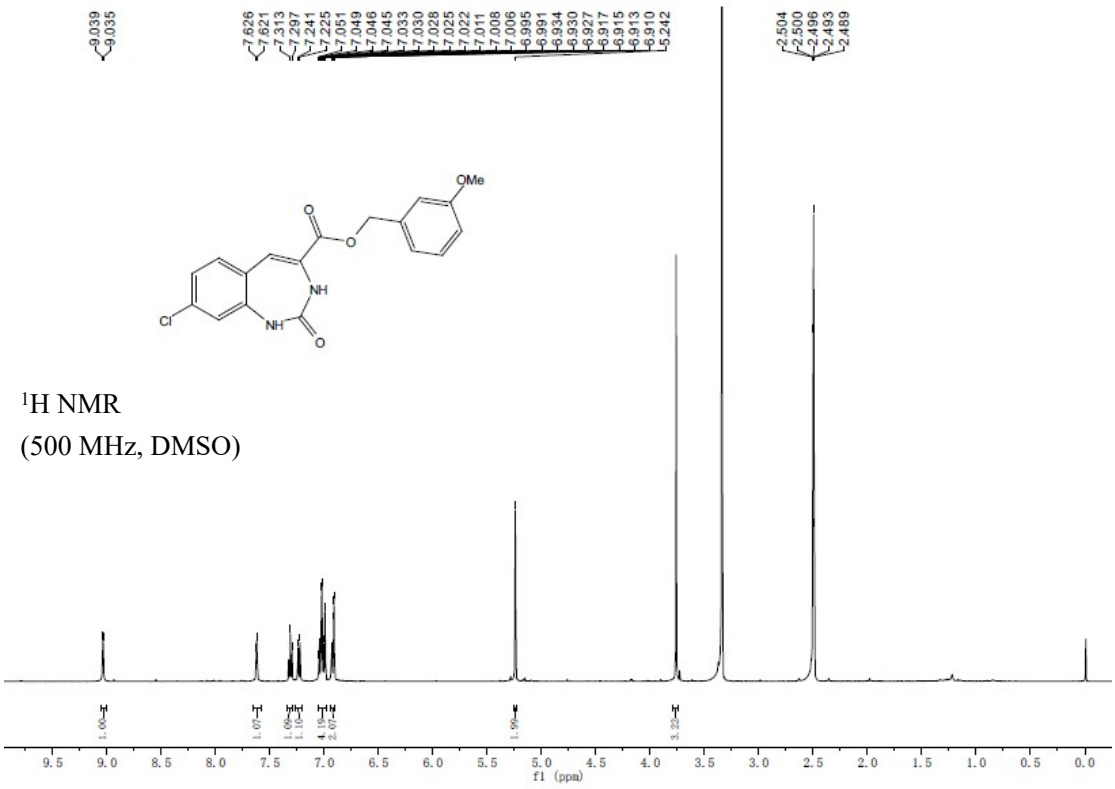


^{13}C NMR

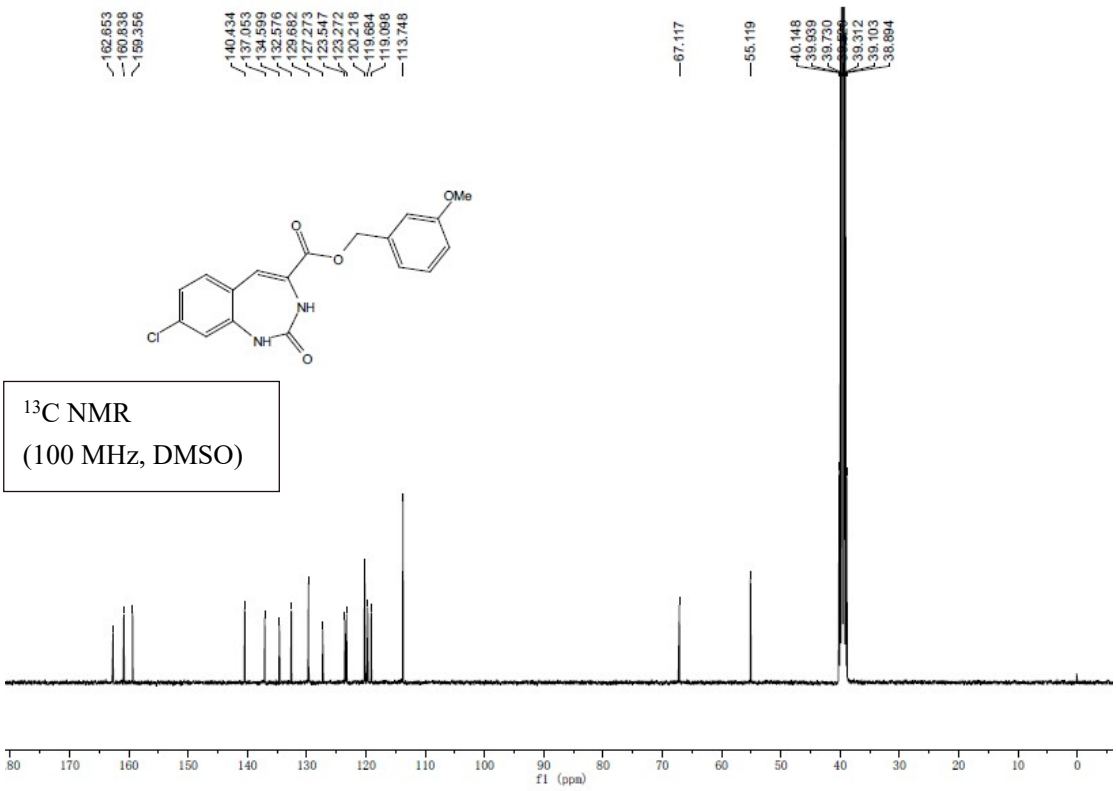
(100 MHz, DMSO)



(3w)

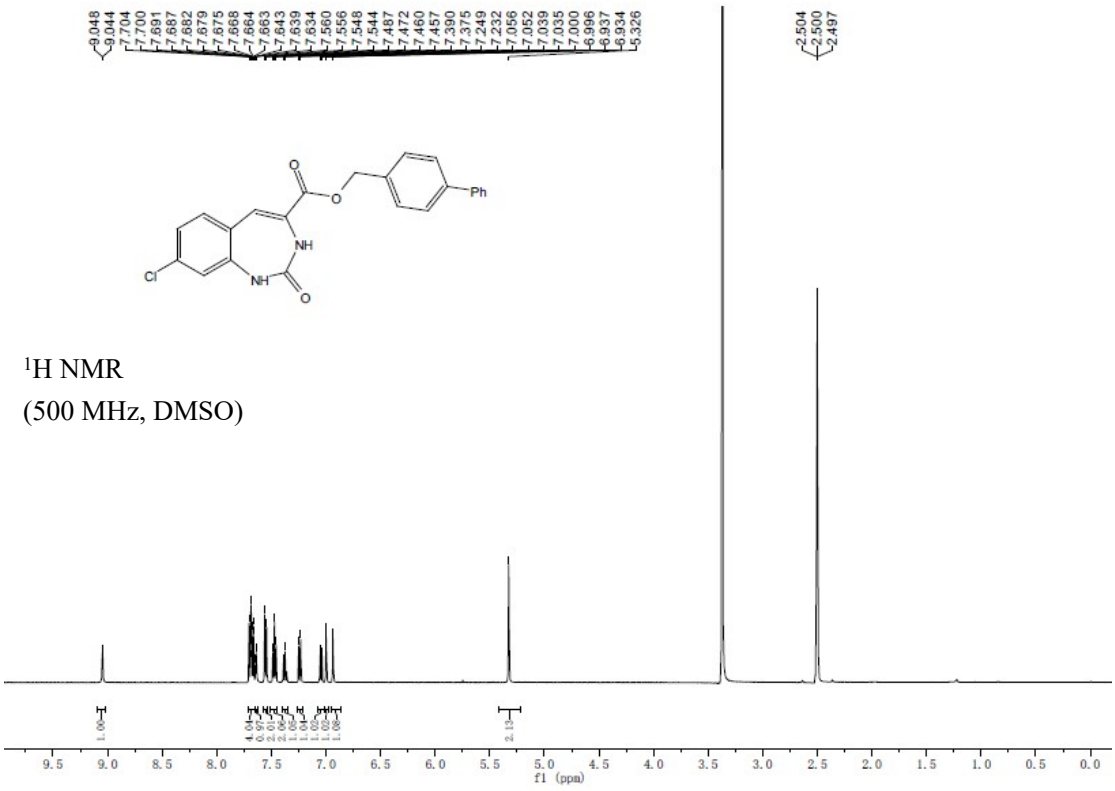


^{1}H NMR
(500 MHz, DMSO)



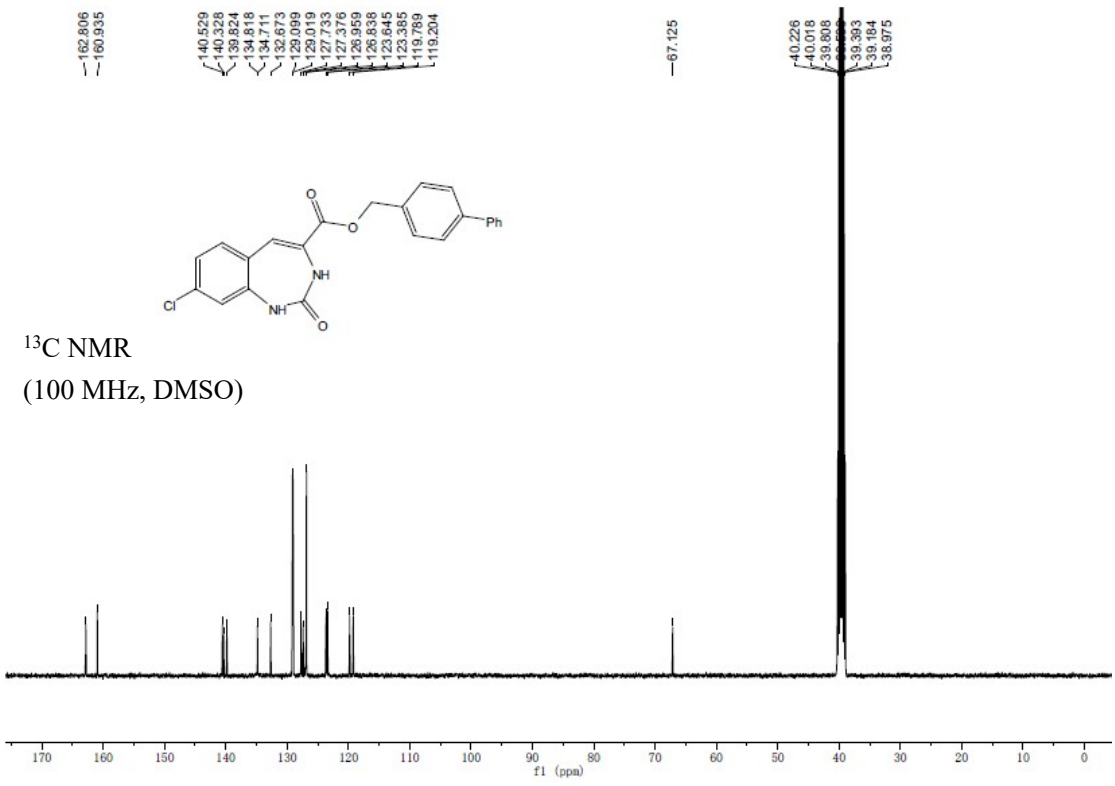
^{13}C NMR
(100 MHz, DMSO)

(3x)



^{1}H NMR

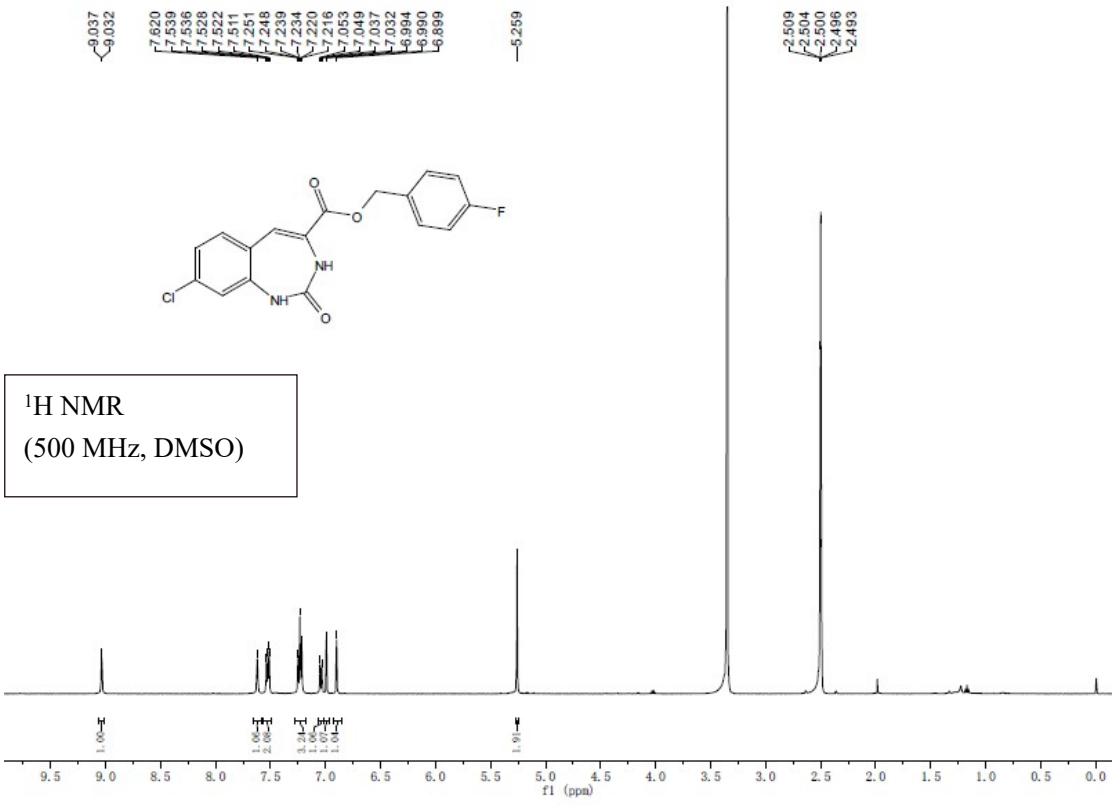
(500 MHz, DMSO)



^{13}C NMR

(100 MHz, DMSO)

(3y)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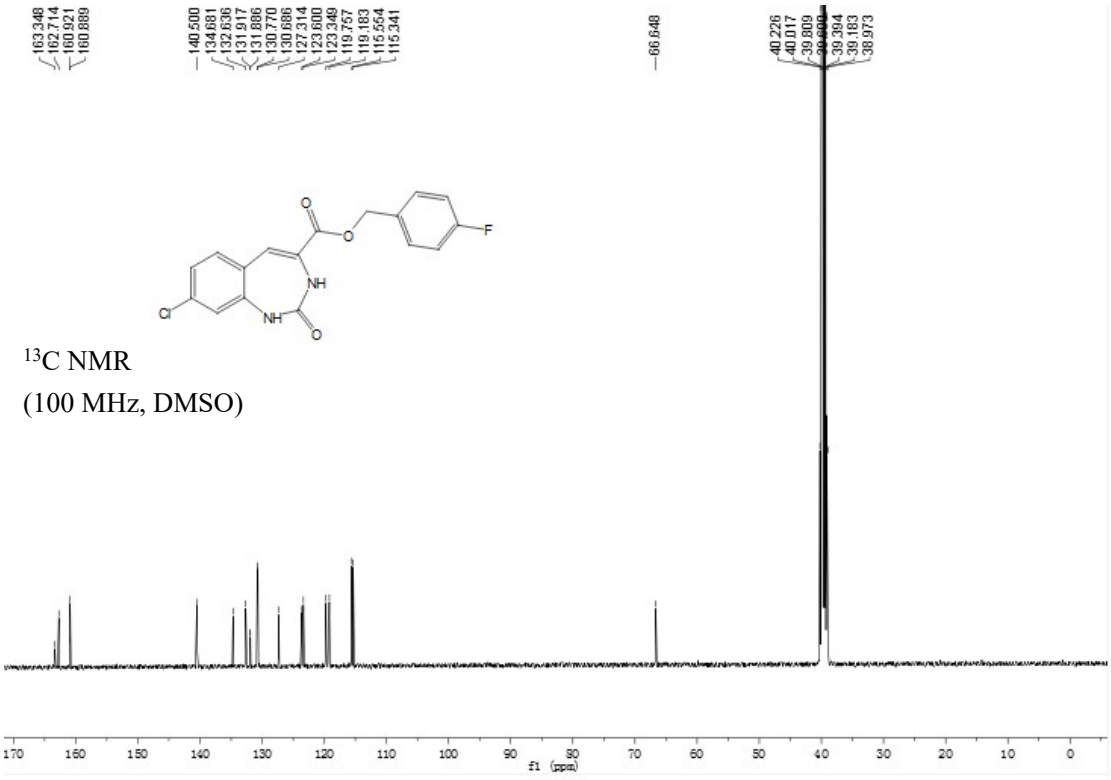
9.032
7.620
7.559
7.536
7.528
7.522
7.511
7.251
7.248
7.239
7.234
7.220
7.216
7.053
7.049
7.037
7.032
6.994
6.990
6.899
5.259
2.509
2.504
2.500
2.496
2.493
O
O
F
NH
Cl
NH
O
1H NMR
(500 MHz, DMSO)
f1 (ppm)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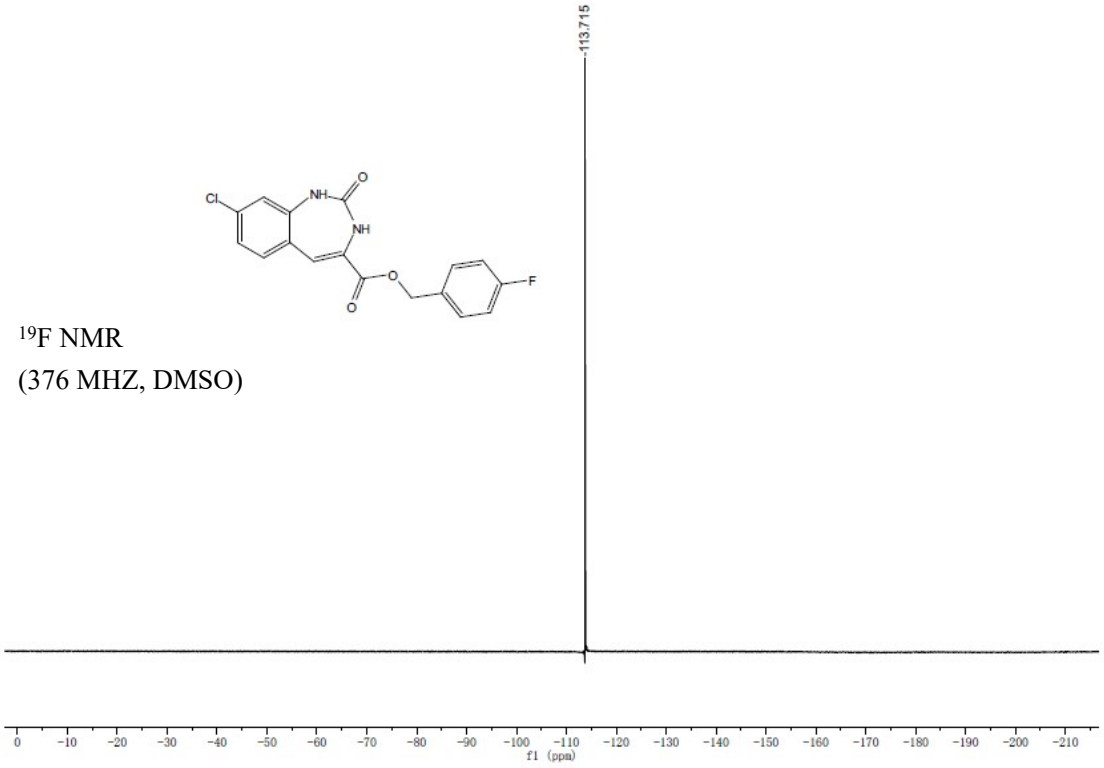
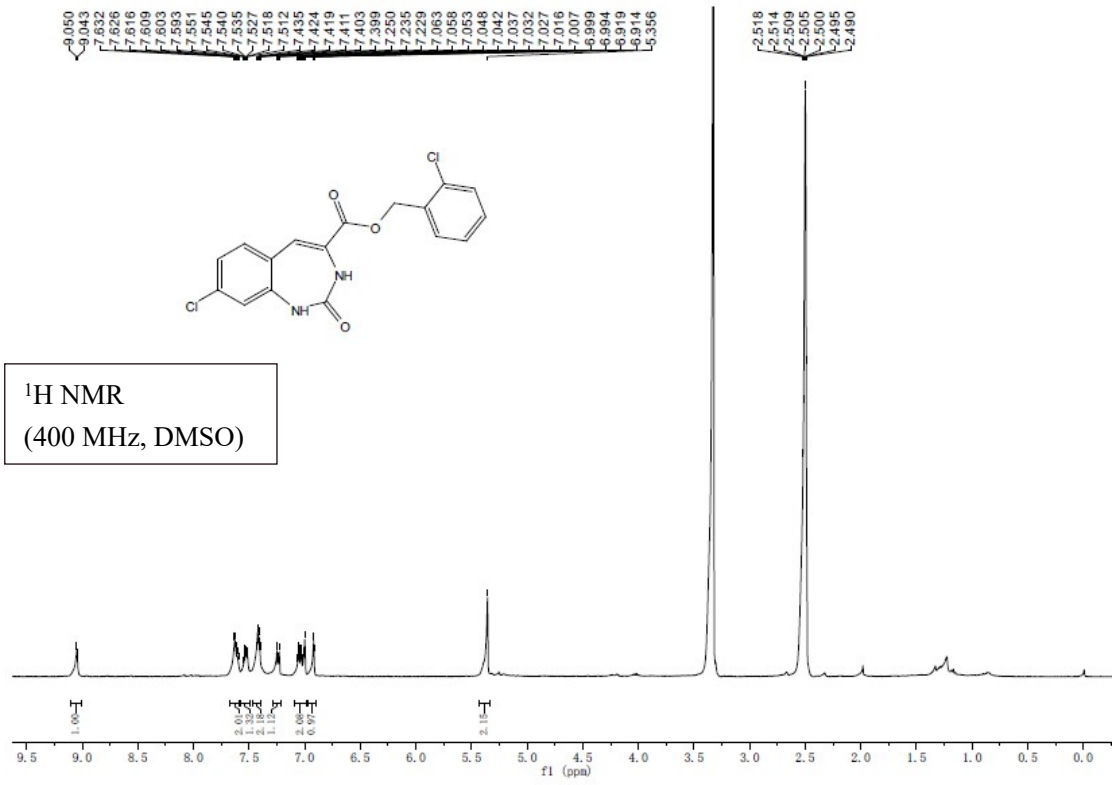
160.921
160.889
140.500
134.681
132.636
131.917
131.886
130.770
130.686
127.314
123.600
123.349
119.757
119.183
115.564
115.341
66.648
40.226
40.017
39.809
39.600
39.394
39.183
38.973
O
O
F
NH
Cl
NH
O
13C NMR
(100 MHz, DMSO)
f1 (ppm)



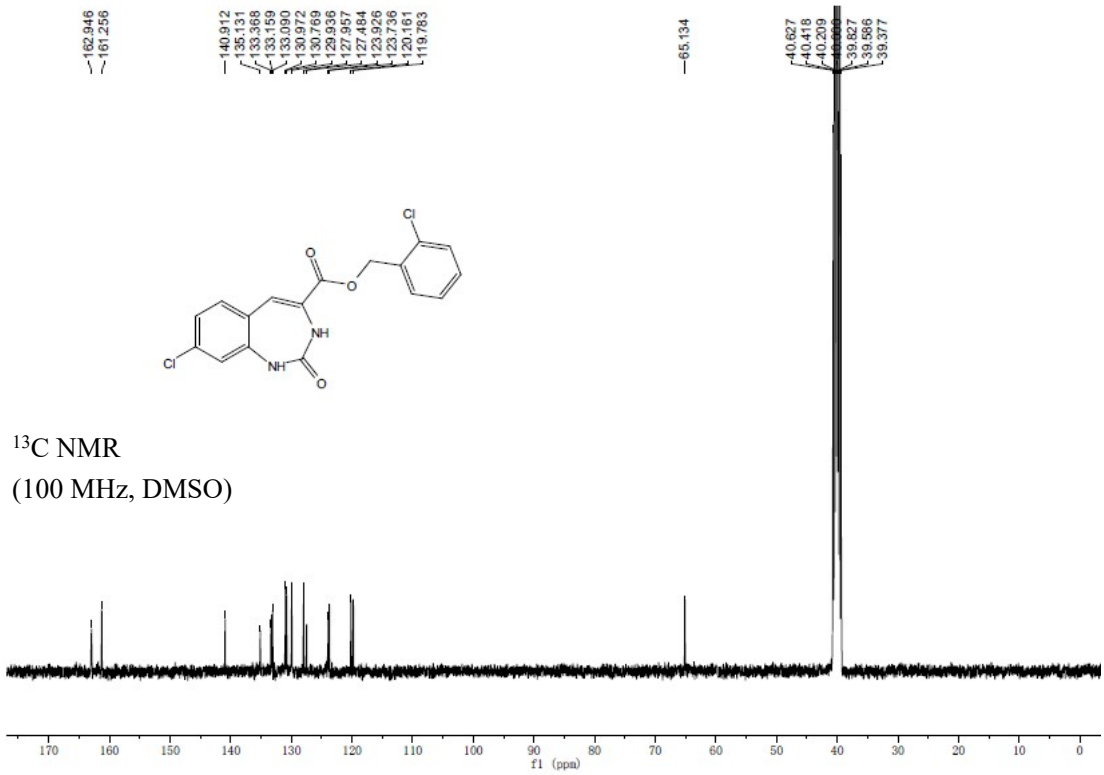
^{19}F NMR

(376 MHZ, DMSO)

(3z)

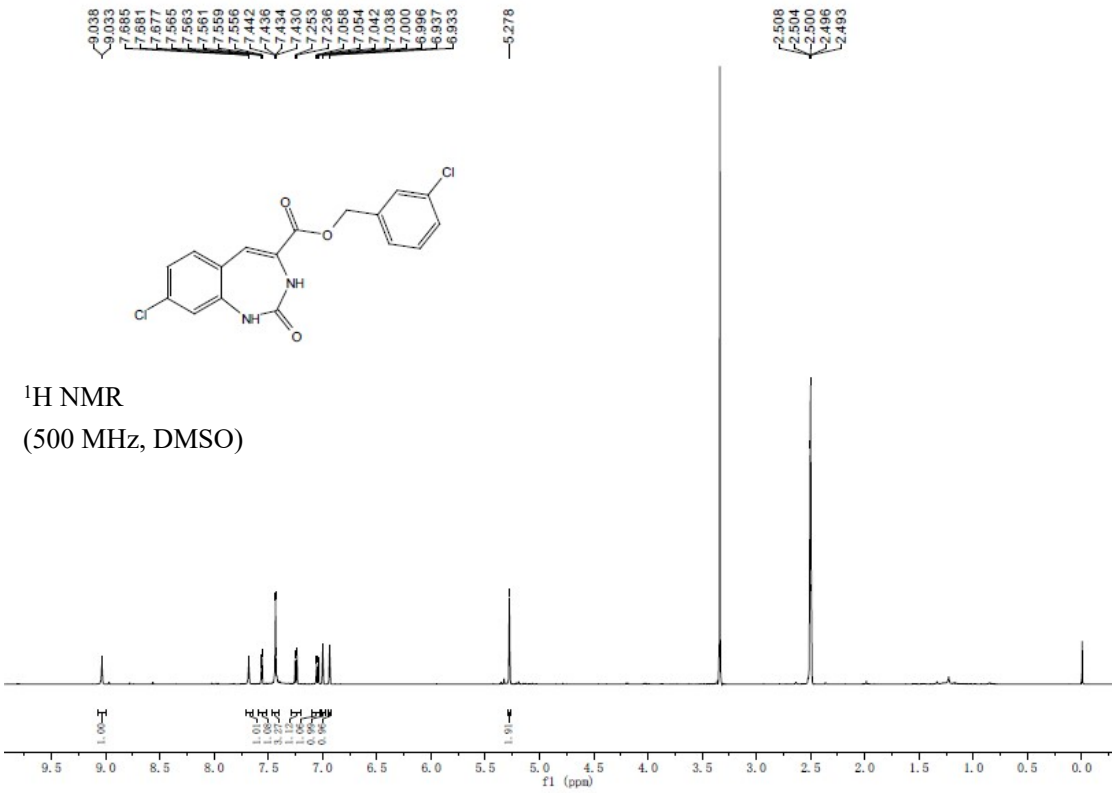


^{1}H NMR
(400 MHz, DMSO)



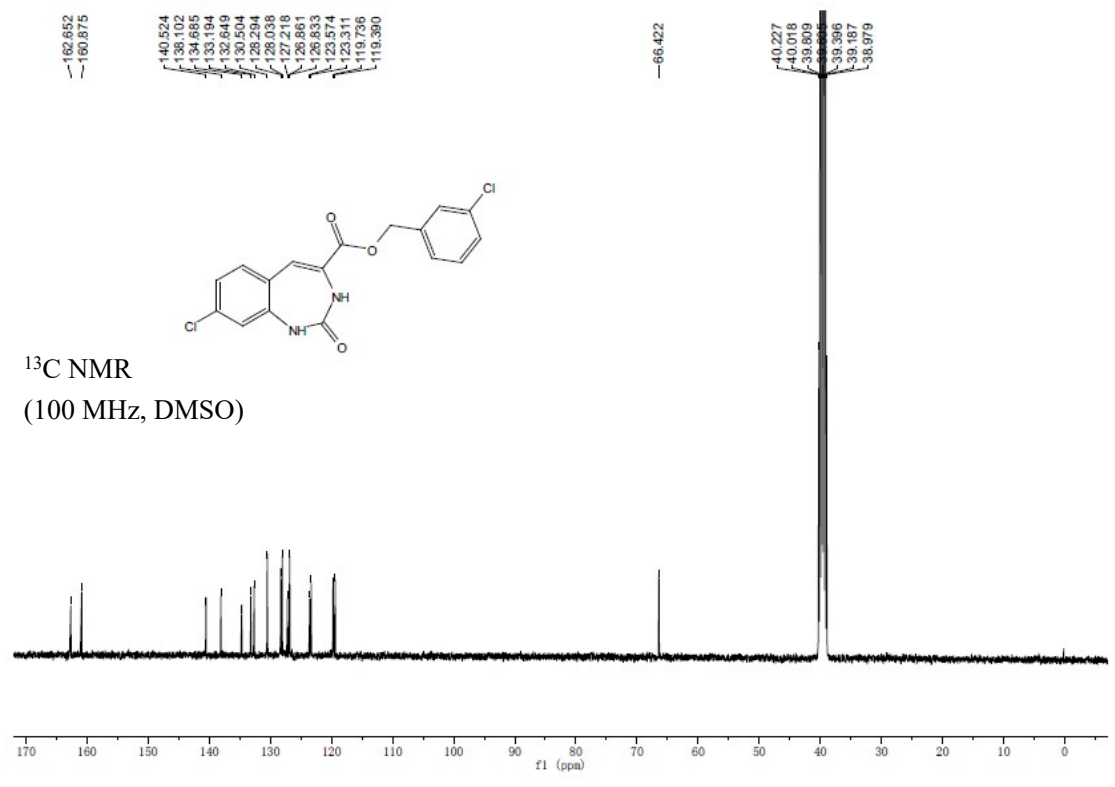
^{13}C NMR
(100 MHz, DMSO)

(3aa)



^{1}H NMR

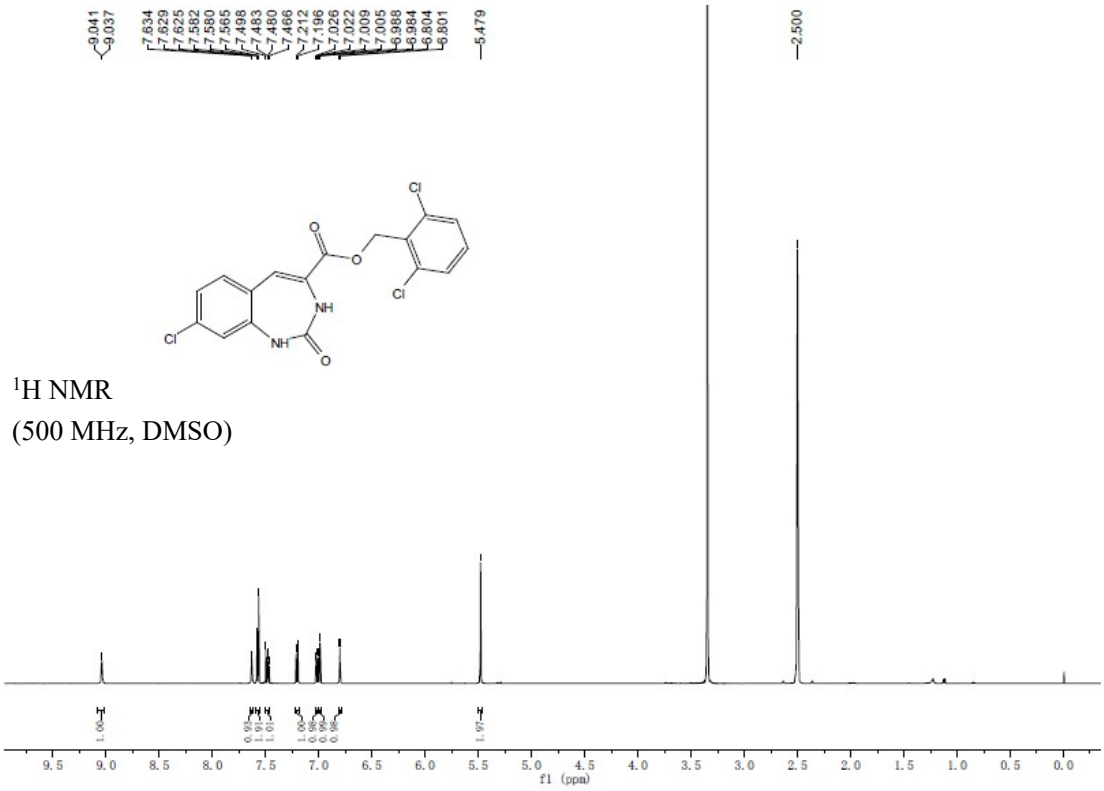
(500 MHz, DMSO)



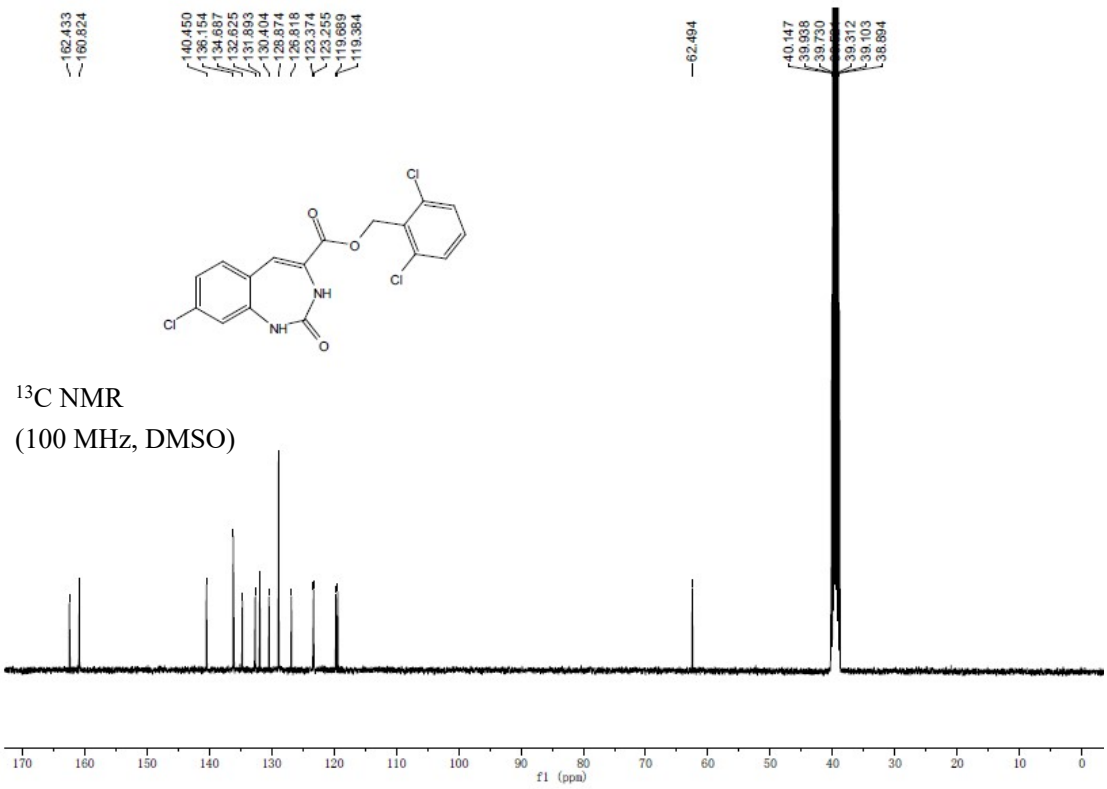
^{13}C NMR

(100 MHz, DMSO)

(3ab)

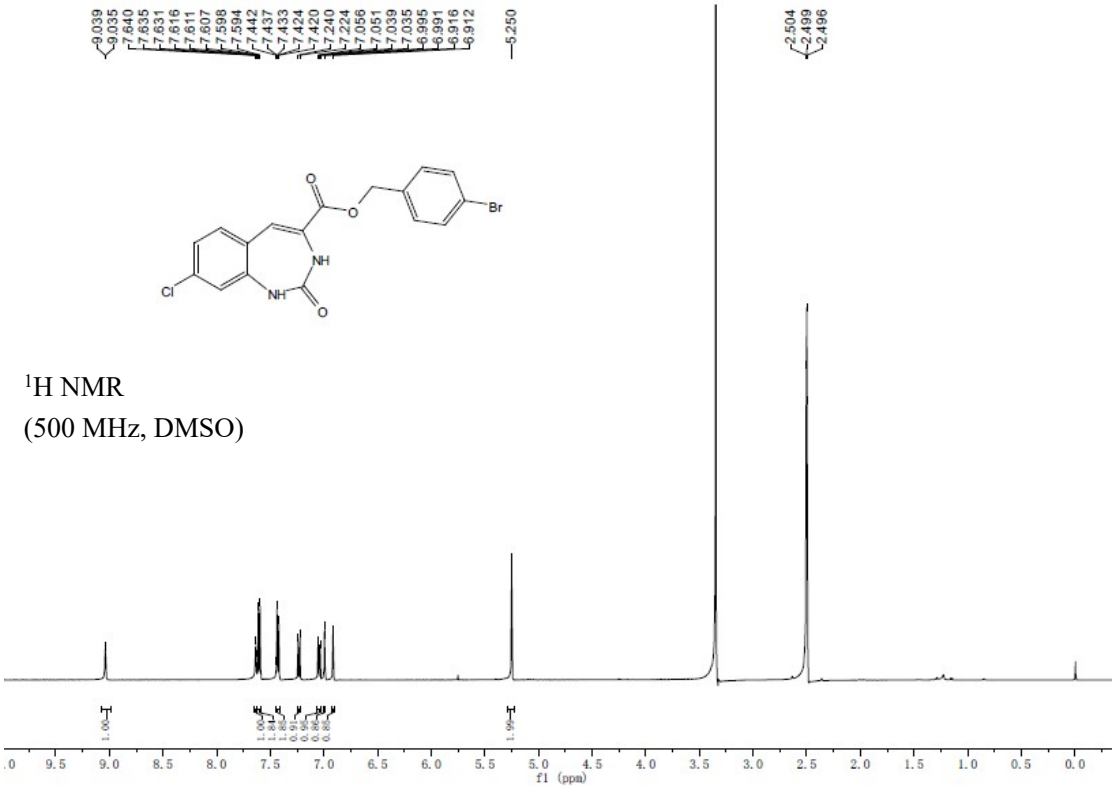


^{1}H NMR
(500 MHz, DMSO)

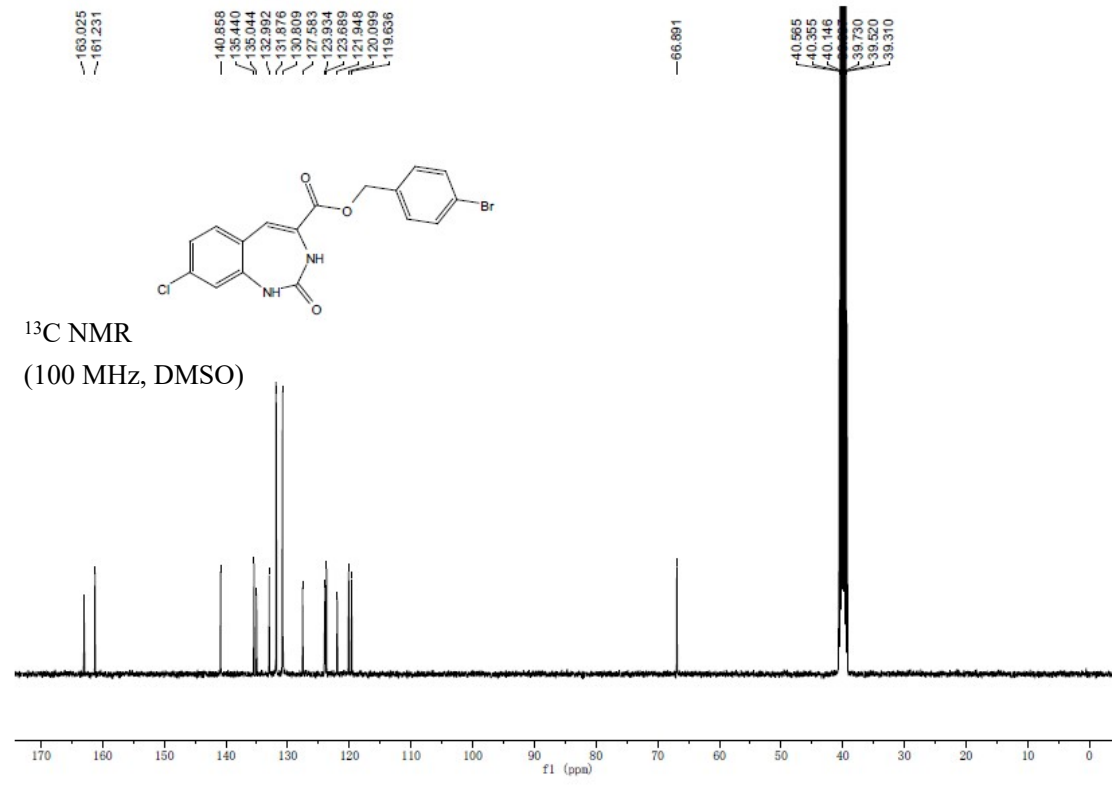


^{13}C NMR
(100 MHz, DMSO)

(3ac)

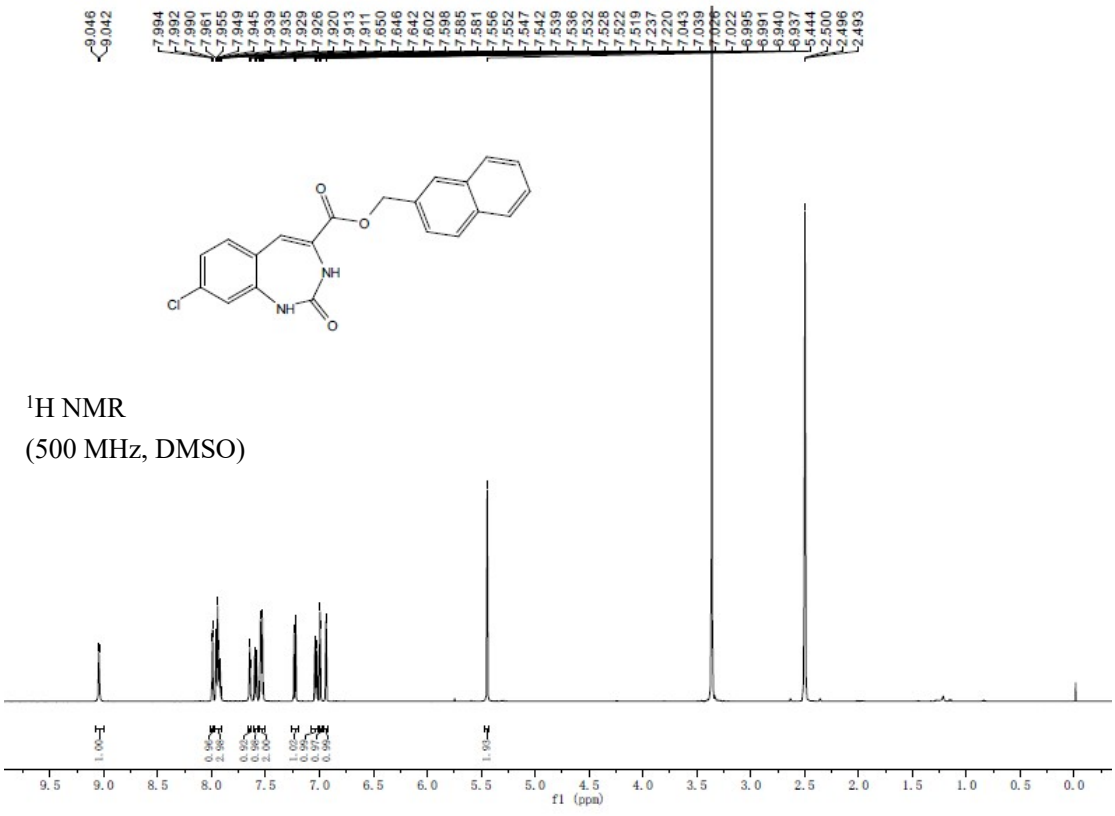


^{1}H NMR
(500 MHz, DMSO)

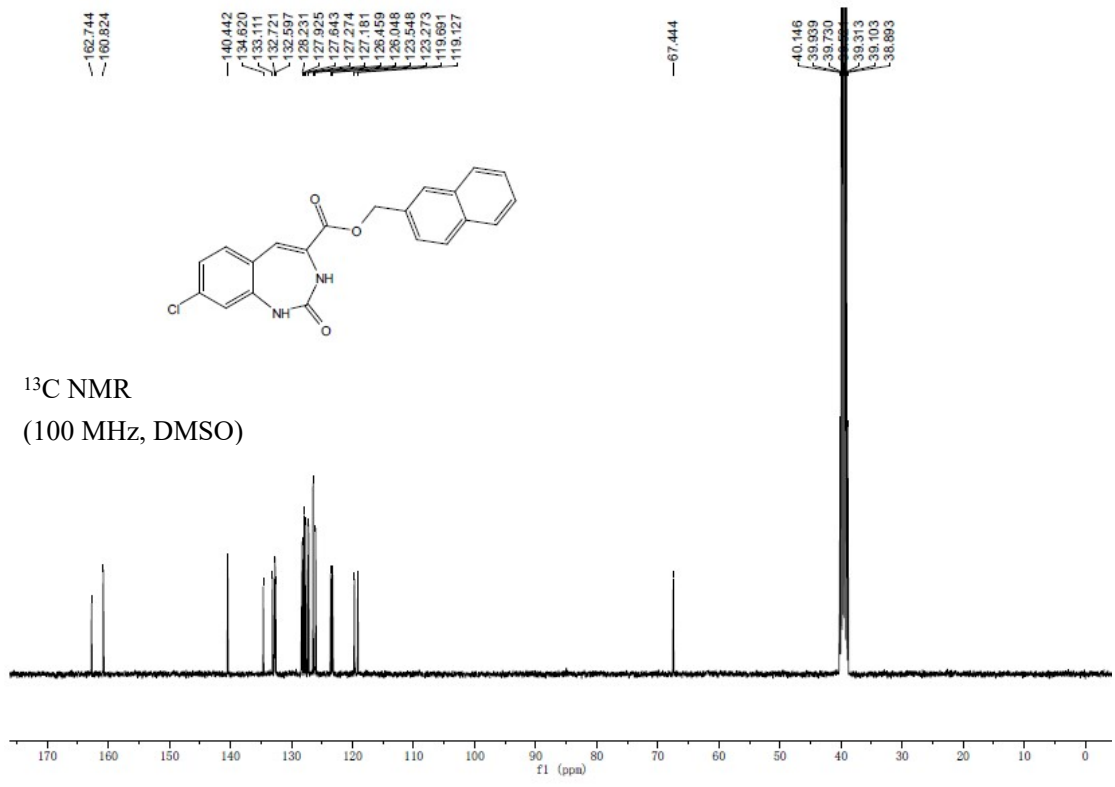


^{13}C NMR
(100 MHz, DMSO)

(3ad)

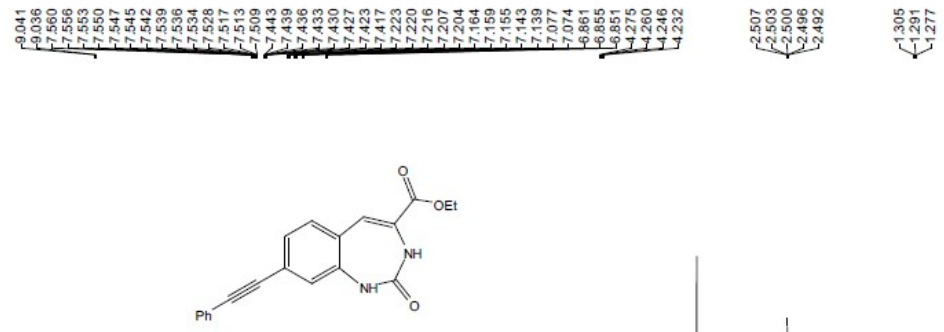


^{1}H NMR
(500 MHz, DMSO)

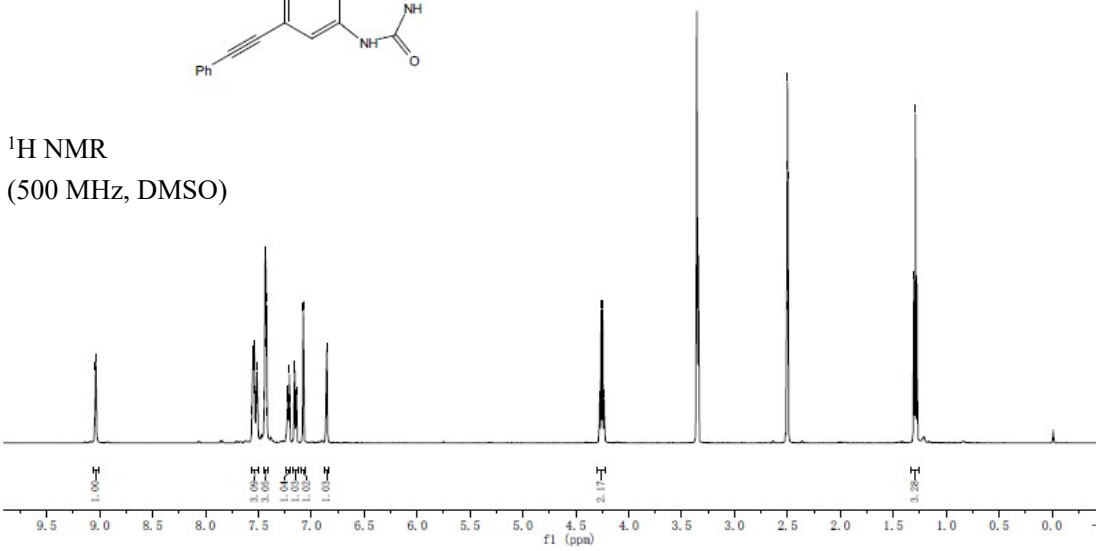


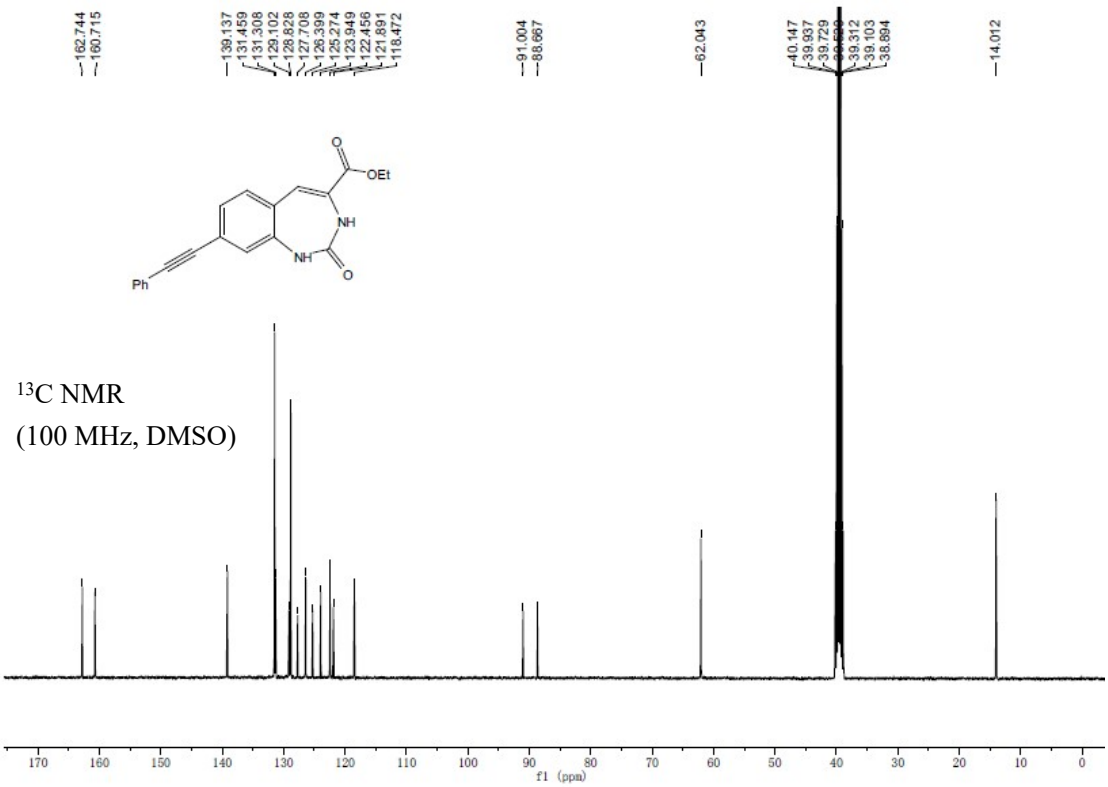
^{13}C NMR
(100 MHz, DMSO)

(4)



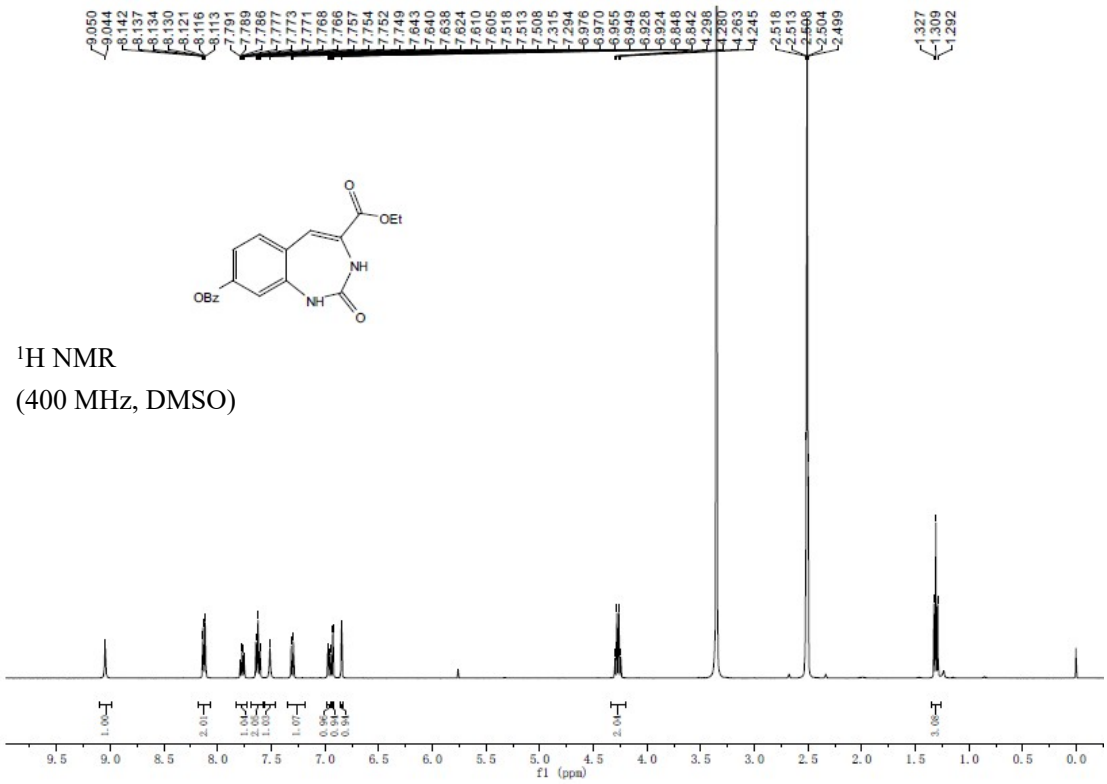
^{1}H NMR
(500 MHz, DMSO)



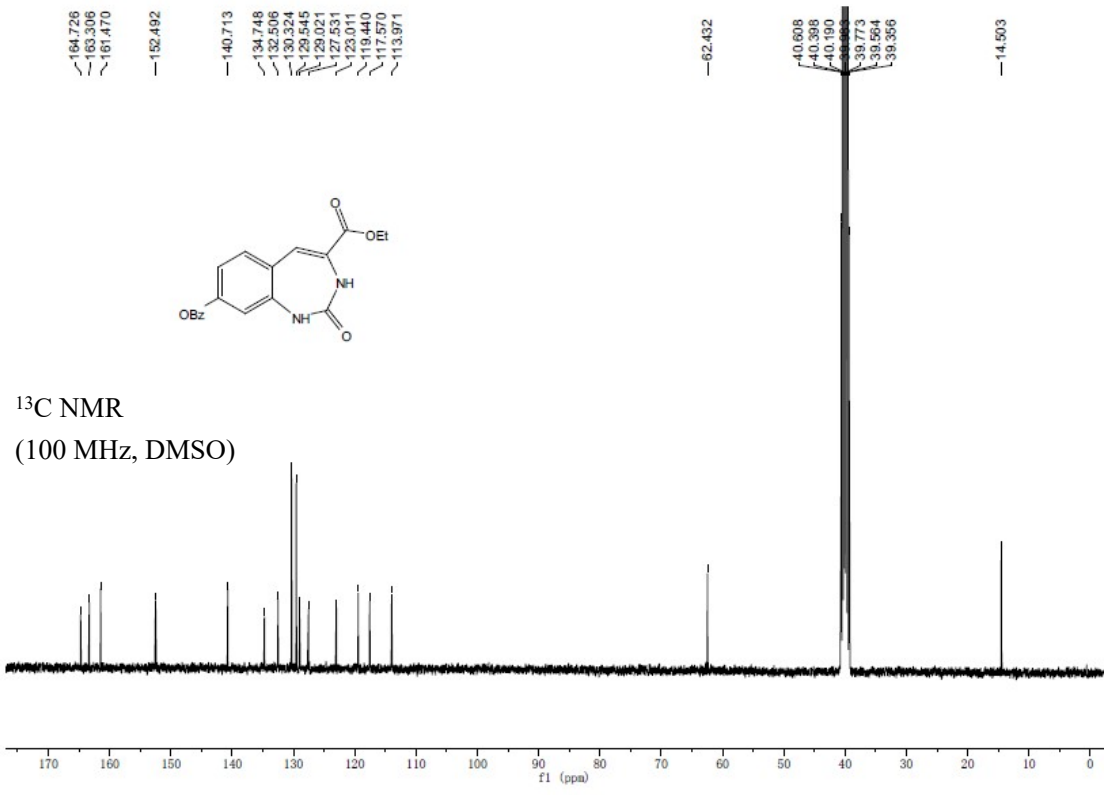


^{13}C NMR
(100 MHz, DMSO)

(5)



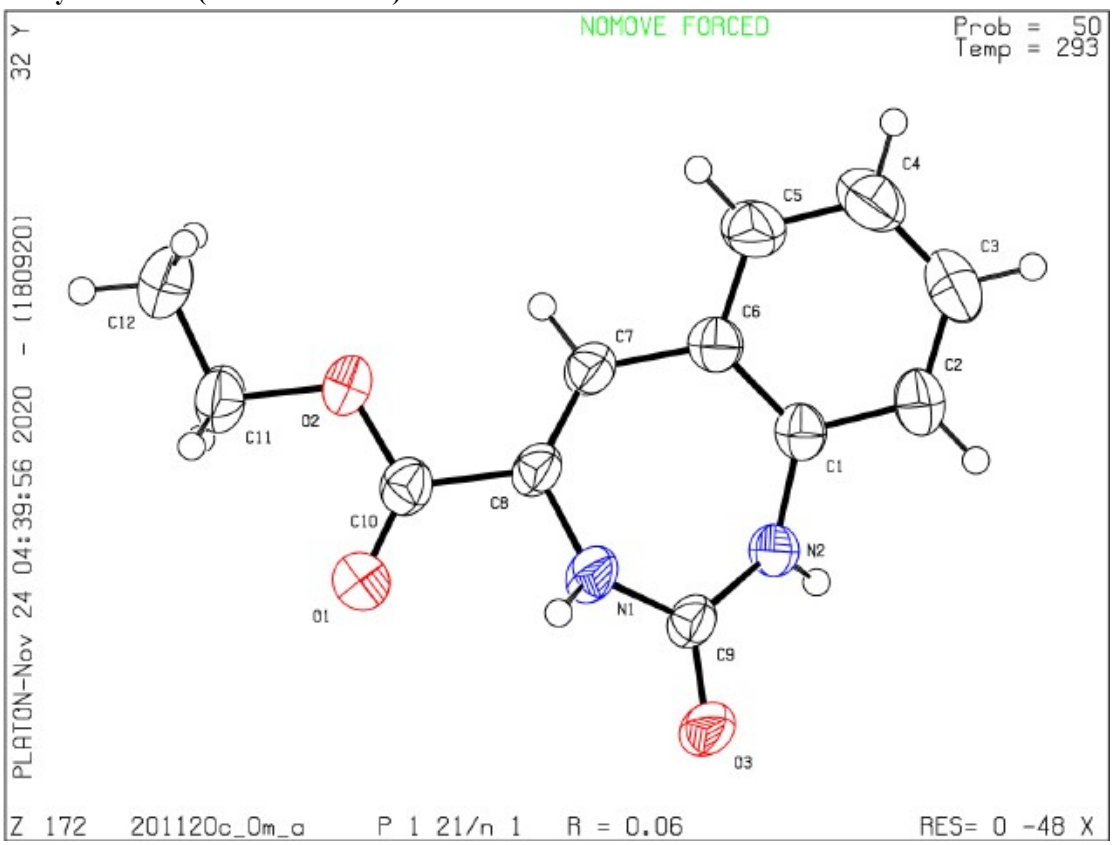
^{1}H NMR
(400 MHz, DMSO)



^{13}C NMR
(100 MHz, DMSO)

VII. X-ray Data

X-ray Data of 3e (CCDC: 2132509)



VIII. References

[1] H.-M. Jin, B. Tian, X.-L. Song, J. Xie, M. Rudolph, F. Rominger, A. S. K. Hashmi, *Angew. Chem. Int. Ed.,* 2016, **55**, 12688.

[2] P. Raju, G. G. Rajeshwaran, M. Nandakumar, A. K. Mohanakrishnan, *Eur. J. Org. Chem.,* 2015, **16**, 3513-3523.

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